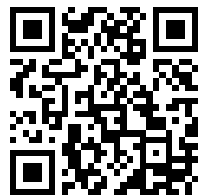

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SAILING DIRECTIONS
FOR THE
WEST COAST OF ENGLAND
FOURTH EDITION.
1891

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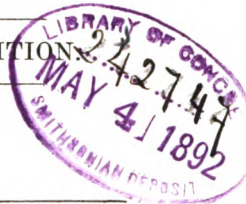
FROM THE

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THE ISLE OF MAN.

FOURTH EDITION



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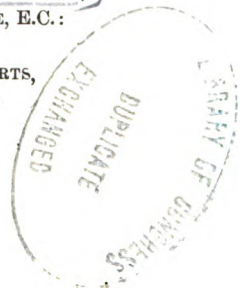
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ADVERTISEMENT TO THE FOURTH EDITION.

The Sailing Directions contained in this work cover the ground formerly included in the two publications "Sailing Directions for the Bristol Channel," and "Sailing Directions for the West Coast of England," and embrace the whole of the West Coast of England and the coasts of Wales, from the Lands End, including the Scilly Islands, to the Mull of Galloway; also the Isle of Man. In them is included all information resulting from the recent surveys of Staff-Commander W. E. Archdeacon, R.N., and other Officers employed on those coasts, as well as much valuable information furnished by the Harbour Authorities of the various places affected.

The Sailing Directions for the Bristol Channel were originally written by Mr. E. K. Calver, Master, R.N., from personal observation, and from the remarks of various other Officers employed on the Admiralty surveys. They were prepared for publication by Captain E. J. Bedford, R.N., in the year 1869.

Revised editions were published in 1872, 1879, and 1884.

The Sailing directions for the West coast of England were compiled by Captain E. J. Bedford, R.N., from similar information, and were published in 1870.

Revised editions were published in 1876 and 1884.

Harbour Authorities and Officers of the Royal and Mercantile Marine, are requested to transmit to the Secretary of the Admiralty, any errors or omissions they may discover, as well as any fresh information they may obtain, in order that this work may be improved for the general benefit of the navigation.

This work, revised by Staff-Commander C. H. C. Langdon, of the Hydrographic Office, cancels the Sailing Directions for the Bristol Channel, 4th Edition, 1884; Sailing Directions for the West coast of England, 3rd Edition, 1884; Hydrographic Notices relating to those Editions, and all Notices to Mariners inclusive of No. 110, of 1891.

W. J. L. W.

Hydrographic Office, Admiralty, London.
March 1891.

**IN THIS WORK THE BEARINGS ARE ALL MAGNETIC, EXCEPT
WHERE MARKED AS TRUE.**

**THE DISTANCES ARE EXPRESSED IN SEA MILES OF 60 TO A
DEGREE OF LATITUDE.**

**A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO 100
FATHOMS.**

**THE SOUNDINGS ARE MOSTLY REDUCED TO LOW WATER OF
ORDINARY SPRING TIDES. AT A FEW PORTS THEY ARE
REDUCED TO EQUINOCTIAL SPRINGS.**

CONTENTS.

CHAPTER I.

BRISTOL AND IRISH CHANNELS.

Approaches, general remarks ; use of the lead ; Labadie and Nymphe banks, soundings	1-3
Approaching Bristol channel :—Directions, ground swell ; harbours of Refuge	3-5
Approaching St. George's channel and Irish sea :—Directions, harbours of Refuge ; channel northward of Ireland	5-8
Winds. Gale tables. Storm warnings. Currents	8-12
Tidal streams :—Mouth of English channel, Bristol channel, Smalls. Irish channel, North channel	12-18
Fogs. Uniform system of buoyage ; light-vessels. Pilots and tugs. Signal stations	18-21

CHAPTER II.

BRISTOL CHANNEL.

SCILLY ISLANDS TO HARTLAND POINT.

Scilly islands :—General remarks ; lights, harbours ; St. Mary's island and road ; St. Mary's and Broad sounds ; tides. New Grimsby. Seven Stones, light-vessel	21-30
Lands End ; Longships ; Sennan ; cape Cornwall ; Brisons ; Bann shoal ; Pendeen cove	
St. Ives ; Hayle ; Godrevy head ; The Stones	35-43
Portreath ; St. Agnes head ; New Quay ; Trevoze head ; Padstow ; port Quin ; port Isaac ; port Gavorne ; Boscastle ; Bude haven ; Hartland quay and point	44-50

CHAPTER III.

BARNSTAPLE BAY TO BRIDGEWATER.

Lundy island :—Refuge, lights, Stanley bank, tidal races, anchorages	51-56
Barnstaple bay :—Clovelly, rivers Taw and Torridge, Barnstaple or Bideford bar, lights, directions, Appledore pool, Barnstaple town	56-62
Westward Ho ; Baggy point ; Morte bay ; Rockham shoal ; Bull point, light ; Ilfracombe	62-67
Buggy overfall ; Watermouth ; Combe Martin ; Lynmouth ; Foreland ; Porlock bay ; Minehead harbour	68-72
Blue anchor road ; Watchet. Bridgewater and river Parret :—Bar, directions ; Bridgewater docks ; Burnham. Culver sand ; Fairways ; Steephelm	73-82

CHAPTER IV.

THE SMALLS ROCKS AND WOOLTACK POINT TO WORMS HEAD.

The Smalls, light, tidal streams; Hats; Barrels; Grassholm; Skokham; Skomar - - - - -	83-88
Mainland:—Wooltack point; Gateholm; Jack sound; Broad sound; Milford Haven approach, directions - - - - -	88-92
Milford Haven:—St. Ann's head, lights, telegraph; capabilities of the Haven; dangers in the approach and within; lights; pilots; anchorages; torpedo ground - - - - -	93-103
Directions; Milford town. docks; Pembroke dock; H.M. Dockyard; Neyland; Cleddan rivers; Haverfordwest - - - - -	104-111
West Freshwater bay; Linney head; Crow and Toe rocks; Eligug stacks; St. Goven's head, new quay; Broad haven; Stackpole head and quay; East Freshwater bay; Manorbier bay; Lidstip bay; Giltar point - - - - -	112-116
Caermarthen bay:—tidal streams. Caldy island, light; Caldy sound and road; dangers in, tides, anchorages, directions - - - - -	117-123
Tenby road and harbour; Saundersfoot bay. Towy and Taff rivers:— Caermarthen bar, directions; Kidwelly; Caermarthen - - - - -	124-131
Burry inlet:—Burry port and docks; Pembrey harbour; Llanelly harbour and docks; Worms head and sound; Burry holm; Sandbanks in Burry inlet; channels, anchorages, directions - - - - -	132-142

CHAPTER V.

WORMS HEAD TO CARDIFF.

Helwick sands, pass, light-vessel; porth Eynon; Oxwich bay - - - - -	143-146
Swansea bay:—Mumbles, light, town; signal station; shoals in the approach; Scarweather sands and light-vessel; Shord channel; Kenfig patches; pilots, directions; Mumbles road; river Tawe - - - - -	146-153
Swansea harbour and docks - - - - -	154-156
Neath river; Briton Ferry dock; Neath dock; New channel, tidal signals. Neath town - - - - -	157-160
Port Talbot; Porthcawl; Dunraven castle; Nash point, lights, sand, directions. Breaksea point and ledge; Roos point - - - - -	160-170
Barry island and dock; Barry road, directions; Sully island; Lavernock point - - - - -	170-172
Dangers in approach to Cardiff:—Breaksea light-vessel; Flatholm island, light; wolves; Cardiff and Penarth road; Cardiff grounds; anchorages; directions - - - - -	172-180
Rivers Ely and Taff; Cardiff and Penarth flats; Penarth harbour and docks; Cardiff docks; tidal signals; town, trade - - - - -	180-187

CHAPTER VI.

ABOVE THE HOLMS. CARDIFF TO KING ROAD.

Newport approach. River Usk; Newport deep, directions; Newport docks	188-192
Southern shore:—Brean Down; Weston or Uphill bay; Clevedon; Walton bay; Portishead	- 192-196
King road, shoals in the approach:—English and Welsh grounds, light-vessel; leading lights; anchorages; King road, Portishead pool; tidal streams; directions	- 197-204
Port of Bristol:—Limits of; river Avon, depths to the city; City; trade, harbour and dock accommodation; Avonmouth and Portishead docks	- 204-208
River Severn:—Depths; pilots; New passage and Portskewet; river Wye and Chepstow; Sharpness; Lydney; Gloucester canal, docks and city; tides and bore of the Severn	- 209-217

CHAPTER VII.

ST. GEORGE'S CHANNEL AND IRISH SEA.—
EASTERN SHORE.

ST. BRIDES BAY TO NEW QUAY.

St. Brides bay:—Gouldtrop road; Little haven; Solva creek; Porthllisky bay; tidal streams	- 218-220
Ramsey island and sound; dangers in; tidal streams; directions; Bishops and Clerks; general directions	- 220-227
Bais bank, clearing marks; St. David's head. Penberry; Abereddy bay, directions; Abercastle; Strumble head and bank; Pen Anglas	- 227-231
Fishguard bay and harbour; Dinas head; Newport bay; river Nevern; Kemmaes head; tidal streams; port Cardigan, bar, island; Teifi river, Cardigan	- 231-238
Traeth mount; Aberporth; New Quay bay and head; New Quay harbour, town	- 238-240

CHAPTER VIII.

CARDIGAN BAY.

Cardigan bay, general remarks, light-vessel; Aberaeron; Cadgwan reef; trawling ground; Rheidol and Ystwith rivers; Aberystwith harbour and town. Clarach patch	- 241-246
Gynfelin patches, channels between; directions, tidal streams; river Dovey; Aberdovey harbour and town; Sarn Bwch	- 246-253
Barmouth harbour, pool, tides, town; Badrig east pass; Sarn Badrig or causeway	- 253-257
Mochras island. Port Madoc. Pwllheli road and harbour, town. Abersoch bay. St. Tudwall's island and sound	- 258-264
St. Tudwall's road, directions. Porth Neigwl or Nigel. Aberdaron bay	- 265-266

CHAPTER IX.

BARDSEY ISLAND TO THE SKERRIES.

Bardsey island, light. Devil's ridge and tail ; Bastram shoal. Bardsey sound	267-269
Carnarvon bay, light-vessel, directions. Braich-y-Pwll head ; porth Iago ; porth Dynlleyn ; Nevin bay ; Yr Eifl	- - - - - 270-274
Menai strait, south-west entrance :—General remarks ; tides ; Llanddwyn island ; Carnarvon bar, directions. Carnarvon. Dinorwic. The Swellies	274-282
Coast of Anglesea :—Malldraeth bay. Crigyll and Cymmeran bays. Holy- head island. Rhoscolyn bay. Abraham's bosom South and North Stacks. Holyhead mount	- - - - - 282-286
Holyhead bay and harbours ; dangers in ; tidal streams. Refuge harbour. Old and Inner harbours. Holyhead town	- - - - - 286-293

CHAPTER X.

THE SKERRIES TO GREAT ORME HEAD.

The Skerries :—Dangers around ; directions. Camlyn bay. Kemmaes bay. Llanlana head. Bull bay	- - - - - 294-300
Amlwch bay. Lynus point, telegraph. Freshwater bay. Dulas bay. Moelfre islet and road. Red Wharf bay. Table road	- - - - - 300-305
Menai strait, north-east entrance :—Trwyn Du light. Beaumaris. Gallows point. Port Penrhyn. Bangor. Sandbanks. Directions	- - - - - 305-313
Beaumaris bay. River Conway ; sands and channels, directions. Great Orme head, light, telegraph	- - - - - 313-317

CHAPTER XI.

GREAT ORME HEAD TO FORMBY POINT.

Orme bay, Llandudno. Constable bank. Abergelé town and road. River Clwyd and Rhyl	- - - - - 318-321
River Dee :—Hilbre islets. Dee light-vessel. Sand banks. Chester flats. Hoyle banks. Salisbury banks. Chester bar, directions. Hilbre swash. Anchorage ; tides ; bore. Upper navigation. Chester city	- - - - - 322-331
Liverpool bay and river Mersey :—General remarks ; lights and light- vessels ; banks ; tides ; tidal streams ; pilots ; lifeboats	- - - - - 332-343
Queen's and Crosby channels ; Horse and Rock channels ; Formby channel ; anchorage	- - - - - 344-349
Liverpool city, docks. Birkenhead docks. Landing stages. Compass adjustment. Time signal. Floating institutions. Birkenhead	- - - - - 350-355
Upper Mersey :—General remarks ; Garston ; Manchester Ship Canal ; Widnes ; Runcorn ; Warrington ; Ellesmere ; tides	- - - - - 356-359

CHAPTER XII.

FORMBY POINT TO THE ENTRANCE TO FIRTH OF SOLWAY.

Ribble river :—General remarks, lights. Entrance channels. Southport.	
Lytham. Preston, depths to ; docks. Blackpool - - -	360-365
Morecambe bay :—Light vessel, anchorages. Approaches to Fleetwood ;	
River Wyre, lights. Fleetwood, pilots, directions, docks - - -	366-372
River Lune :—Lights, sands, directions ; Glasson dock. Lancaster. Heysham	
lake - - - - -	372-376
Morecambe approach, light vessel, harbour. Ulverston channel, Ulverston	376-379
Piel harbour :—Lights, buoyage ; channel above Piel, directions. Barrow	
docks, lights. Walney island - - - - -	380-385
Duddon river :—Millom town, directions. Selker rocks, light-vessel.	
Ravenglass harbour. Seascale, measured mile - - - - -	386-389

CHAPTER XIII.

ST. BEES' HEAD TO MULL OF GALLOWAY.

FIRTH OF SOLWAY.

Firth of Solway :—General remarks, tidal harbours in ; tidal streams.	
Southern shore :—St. Bees' head, light, telegraph. Saltom bay - - -	390-392
Whitehaven harbours, town ; Harrington harbour ; Workington harbour,	
town - - - - -	392-398
Maryport road and harbour, docks, pilots. Maryport. Allonby bay - - -	399-402
Sand banks in Solway. Approach to Silloth, bar, light-vessel. Directions.	
Silloth wet dock, lights, town. River Annan. Bowness. Port Carlisle.	
Carlisle city - - - - -	402-411
Northern shore :—Abbey head. Auchencairn and Hestan bays. Rough	
firth. Urr water. Barnhowrie sand. Southernness - - - - -	411-414
River Nith ; Dumfries. Sand banks on north shore of the Firth. Dumfries,	
Barbara and Powfoot channels - - - - -	415-417
Kirkcudbright bay ; Little Ross island ; River Dee, Kirkcudbright, tides,	
directions - - - - -	417-420
Wigton bay :—Tidal streams. Bridgehouse bay. Fleet bay. Creetown.	
Palnure. Burrow head. Port Whithorn. Yerrook bay. Garliestown.	
Wigton sands. Wigton - - - - -	420-427
Luce bay :—Tidal streams. Port William. Kinfillan bay. Mull of	
Galloway, light. East Tarbat bay. Drummore. Head of Luce bay	428-432

CHAPTER XIV.

ISLE OF MAN.

Isle of Man :—general description. Calf of Man. Chicken rock, light :	
Calf sound, tides. Poyll Vaaish bay. Port St. Mary. Castletown bay	
and harbour. Langness, light. Derby bay and haven - - -	433-441
Douglas head and bay :—dangers in ; anchorage. Douglas harbours ; town.	
Laxey bay. Ramsey bay, harbour and town - - -	442-449
Ayre point, lights. Bahama bank ; light-vessel. King William banks,	
West coast. Orrisdale head. Peel town and harbour - - -	449-453
West coast tidal streams. Port Erin, breakwater ; lights - - -	454-456
List of Sailing Directions published by the Hydrographic Department of	
the Admiralty, February 1891 - - - - -	493-498
List of Admiralty Agents for the sale of Charts in the United Kingdom -	499
" " " " " " Abroad - - -	500

PRONUNCIATION OF LETTERS IN WELSH GEOGRAPHICAL NAMES.

Charac- ters.	Pronunciation.	Charac- ters.	Pronunciation.
a	as <i>a</i> in <i>mat</i> .	m	as in English.
b	as in English.	n	as in English.
c	as English <i>k</i> .	ng	as <i>ng</i> in <i>length</i> .
ch	as <i>ch</i> in <i>loch</i> .	o	<i>o</i> in <i>fore</i> is the nearest sound.
d	as <i>d</i> in <i>bed</i> .	p	as in English.
dd	as <i>th</i> in <i>leather</i> .	ph	as <i>f</i> in <i>for</i> .
e	as <i>e</i> in <i>then</i> , and <i>a</i> in <i>mare</i> .	r	rougher than in English.
f	as <i>v</i> , or <i>f</i> in <i>of</i> .	s	hard, as <i>s</i> in <i>say</i> .
ff	as <i>f</i> in <i>for</i> .	t	as <i>t</i> in <i>to</i> and <i>at</i> .
g	as <i>g</i> hard, as in <i>beg</i> .	th	as <i>th</i> in <i>pith</i> , <i>thing</i> .
h	as <i>h</i> in <i>horrid</i> , strong aspirate.	u	as <i>e</i> in <i>me</i> , and <i>i</i> in <i>thin</i>
i	as <i>e</i> in <i>me</i> , and <i>i</i> in <i>thin</i> .	w	as <i>o</i> in <i>do</i> , or <i>oo</i> in <i>good</i> .
l	as in English.	y	as <i>u</i> or <i>i</i> in <i>fur</i> or <i>fir</i> .
ll	more like <i>thl</i> than any English sound. Thus <i>Dolgelly</i> is pronounced something like <i>Dolgethly</i> .		

GLOSSARY OF WORDS COMMON ON THE COAST
OF WALES.

Welsh.	Signification.
Aber - - - -	The mouth of a river.
Afon - - - -	A river.
Bach or Fach - - - -	Little.
Carreg or Carrick - - - -	Rock, a stone.
Clyt - - - -	A patch of rock.
Dau - - - -	Two.
Du - - - -	Black.
Isaf - - - -	Lower.
Llan - - - -	Area, church.
Llech - - - -	A flat stone.
Maen - - - -	A stone, a rock.
Mawr or Fawr - - - -	Great.
Moel - - - -	Bare, conical hill.
Pen - - - -	Head, high point.
Pont - - - -	A bridge.
Porth - - - -	A port, harbour.
Pwll - - - -	A pool or creek.
Sarn - - - -	A causeway.
Traeth - - - -	A sand.
Trai - - - -	The ebb shore, exposed by the ebb tide.
Uchaf - - - -	Upper.
Ynys - - - -	An island.

INFORMATION RELATING TO CHARTS, SAILING DIRECTIONS, AND THE GENERAL NAVIGATION OF H.M. SHIPS.

ON THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

There are three descriptions of publications as guides to navigation—the charts, the sailing directions, and the light lists—which are all affected by the continual changes and alterations that take place.

Of these the charts should always be, so far as our knowledge permits, absolutely correct to date; and the light lists should be noted for the recent alterations, though space will not permit of full details being always inserted. The sailing directions, however, cannot, from their nature, be so corrected, and *in all cases where they differ from charts, the charts must be taken as the guide.*

Charts.—When issued to a ship on commissioning, the charts have received all necessary corrections to date. As sent from the Hydrographic Office they are, as a rule, fresh from the plates. They then receive such corrections by hand in the dépôts as are required, and are so issued to the ships.

All small but important corrections that can be made by hand are notified by Notices to Mariners, and should at once be placed on the charts to which they refer.

Large corrections that cannot be conveniently thus made are put upon the plates, and fresh copies are issued to the ships to replace the others, which are directed to be destroyed to prevent the possibility of their being used in the navigation of the ship.

The dates on which these large corrections are made are noted on the chart plates in the middle of the lower edge; those of the smaller corrections at the left-hand lower corners.

In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart, in order that at the Admiralty it may be known what edition of the chart is referred to.

The Light Lists, annually published at the beginning of each year, are not corrected in the dépôts before issue, but appendices are issued every two months, giving the alterations that have taken place, copies of which are put into the chart boxes.

It is the duty of the navigating officer when he receives the set of charts to make notations in the light lists from these appendices, and from the Notices to Mariners in the box; and to keep them so corrected from time to time.

The Light Lists should always be consulted as to the details of a light, as the description in the Sailing Directions may be obsolete, in consequence of changes made since publication.

The Sailing Directions are not corrected before issue, except occasionally for very important new rocks or dangers. Hydrographic Notices and Supplements referring to each volume are published from time to time.

Supplements contain all the information received up to date since the publication of the volume to which they refer, and cancel all previous Hydrographic Notices.

Hydrographic Notices contain all information up to date since the publication of the volume, or since the last Supplement or Hydrographic Notice, but endeavour is made to issue no more than one of these affecting each volume, and, on the collection of fresh information, to include the former Notice in a Supplement.

~~The existence~~ of Supplements or Hydrographic Notices is to be noted, ~~in the tabulated form now being placed for the purpose inside the cover of each volume,~~ in cases when such notations have not been made before issue, and also on receipt of further Notices after commission.

Notes should be made in the margin of the volume of sailing directions affected, as references to the Supplements or Hydrographic Notices when the latter are printed on both sides.

To enable the books to be more conveniently corrected, however, such Supplements and Hydrographic Notices as are of moderate size are now being printed on one side only, and two copies are issued to each ship; one to cut up, the slips being pasted in at the appropriate place; the other to retain intact for reference.

To make these notations or paste in these slips is one of the early duties of a navigating officer after drawing his box of charts and books, and similar notes are to be made from Notices to Mariners that may thereafter be received.

It must, however, be thoroughly understood that sailing directions will never be correct in all details, except up to the date of the last Hydrographic Notice or Supplement, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide; for which purpose, for ordinary navigation, they are sufficient.

THE USE OF CHARTS AS NAVIGATIONAL AIDS.

Accuracy of a Chart.—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger is the scale of the chart.

To estimate this, the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail, and until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been

found. The fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep it may with fairness be assumed that in the blanks the water is also deep ; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch.

A wide berth should therefore be given to every rocky shore or patch.

Fathom Lines a Caution.—Except in plans of harbours that have been surveyed in detail, the five-fathom line on most Admiralty charts is to be considered as a caution or danger line against unnecessarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the time required for such a detailed examination does not permit of its execution, nor do the necessities of the case demand it.

The ten-fathom line is, on rocky shores, another warning, especially for ships of heavy draught.

Charts where no fathom lines are marked must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Distortion of Printed Charts.—The paper on which charts are printed has to be damped. On drying distortion takes place, from the inequalities in the paper, which greatly varies with different paper and the amount of the original damping ; but it does not affect navigation. It must not be expected that accurate series of angles taken to different points will always exactly agree, when carefully

plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

Chart on largest scale always to be used.—It sometimes happens that, from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive rearrangement of coastline or soundings. This is an additional reason, besides the obvious one of the greater detail shown on a larger scale chart, why this largest scale chart should always be used for navigating.

Caution in using small Scale Charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile. This is particularly to be observed when coming to an anchor on a narrow ledge of convenient depth at some distance from the shore.

For the same reason bearings to objects near should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

Lights.—All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of an observer's eye of 15 feet. The table in the Light List affords a means of ascertaining how much more or less the light is visible should the height of the bridge be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be afterwards obtained from the standard compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its order, as given in the Light List, and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus, a light standing 200 feet above the sea and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of any power. (*See table of distances visible, due to height, at end of Light List.*)

Fog Signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from wind, large areas of silence have been found in different directions and at different distances from the origin of a sound, even in clear weather. Therefore too much confidence should not be felt in hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly towards the land, and is not observed by the people at a lighthouse until it is upon them; whereas a ship may have been for many hours in it, and approaching the land. In such a case no signal may be sounded. When sound has to travel against the wind, it may be thrown upwards; in such a case, a man aloft might hear it when it is inaudible on deck.

Taken together, these facts should induce the utmost caution in closing the land in fogs. The lead is generally the only safe guide.

Tides and Tidal Streams.—In navigating coasts where the tidal range is considerable, caution is always necessary. It should be remembered that there are indraughts to all bays and bights, although the general run of the stream may be parallel to the shore.

The turn of the tidal stream off shore is seldom coincident with the time of high and low water on the shore. In open channels, the tidal stream ordinarily overruns the turn of the vertical movement of the tide by three hours, forming what is usually known as tide and half-tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

In crossing a bar or shallow flats, the table (B) at page 98 of the Tide Tables will be found of great assistance in calculating how much the water has risen or fallen at any hour of the tide.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can never be depended upon, and additional caution is necessary.

It should also be remembered that at times the tide falls below the level of low-water ordinary springs. This always occurs in temperate regions at the equinoxes, but wind may produce it at any time, and the amount varies with locality. When the moon's perigee coincides with the full or new moon the same effect is often produced.

Fixing Position.—The most accurate method of fixing a position relative to the shore is by angles between well-defined objects on the chart. All ships are now being supplied with a station pointer, and this method should be used whenever possible.

Two things are, however, necessary to its successful employment. First, that the objects be well chosen ; and second, that the observer is skilful and rapid in his use of the sextant.

For the former, reference can be had to the pamphlet on the use of the station pointer, which is in every chart box.

The latter is only to be obtained by practice.

It will readily be seen that in war time, when the compass may be knocked away, or rifle-fire may make it undesirable to expose the person more than necessary, a sextant offers great advantages, as angles can be obtained from any position whence the objects are visible. It is this contingency that makes it especially desirable that all navigating officers should become expert in this method of fixing a ship's position.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud banks, navigation by sextant and station-pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

It is not intended that the use of the compass to fix the ship should be given up ; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed.

In all cases where great accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In all such cases angles should be taken to several objects, the more the

better ; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. In the case of ordinary soundings, it is only necessary to take a third angle now and then ; firstly, to check the general accuracy of the chart as above stated ; secondly, to make certain that the more important soundings, as at the end of a line, are correctly placed.

Sometimes, when only two objects are visible, a compass bearing and sextant angle may be used with advantage.

In passing near a point of land, or an island, the method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "four-point bearing," when the bearing is taken four points on the bow, and on the beam, the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives an excellent fix for a departure, but does not ensure safety, as the point, and probably the rocks off it, are abeam before the position is obtained.

By taking the bearings of two points and four points on the bow, a very good position is obtained before the object is passed ; the distance of the latter at the second position being, as before, equal to the distance run in the interval

The use of a danger angle in passing outlying rocks with land behind should also not be forgotten. In employing this method, however, caution is necessary, as should the chart be not accurate, *i.e.*, should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

In fixing by the compass, it must always be remembered that two bearings only are liable to error. An absolute error may be made in either bearing observed ; errors may be made in applying the deviation ; or errors may creep in in laying them on to the chart. For these reasons, a third or check bearing of some other object should be taken, especially when near the shore or dangers. The coincidence of these three lines will prevent any mistakes.

The tripod now supplied to all ships to hold the lamp over the standard compass will be found of great service in fixing position at night, as by its aid a bearing can be as accurately taken as in

daylight. Its use in connection with ascertaining the change of bearing of an approaching ship's light should not be forgotten.

Amongst astronomical methods of fixing a ship's position, attention is drawn to the great utility of Sumner's method. A Sumner line, that is, a line drawn through the position (obtained by an assumed latitude and longitude by chronometer) at right angles to the bearing of the sun, as obtained from the azimuth tables, gives at times invaluable information, as the ship must be somewhere on that line. A deep cast at the same time may often serve to get an approximate position on the line. An early and very accurate position can be also obtained by Sumner's method, by getting longitude by a bright star at daylight when the horizon is well visible, and another longitude by the sun when a few degrees above the horizon. The Sumner lines drawn through the two positions thus obtained will, if the bearing of sun and star differ three points or more, give an excellent result.

Current Arrows on charts only show the most usual or the mean direction of a tidal stream or current. It must never be assumed that the direction of a stream will not vary from that indicated by the arrow. In the same manner, the rate of a stream constantly varies with circumstances, and the rate given on the chart is merely the means of those found during the survey, possibly from very few observations.

Change of Variation of the Compass.—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change, may be of importance. The compasses are re-engraved when the error amounts to a quarter of a point, but the chart plates cannot be corrected more frequently from the impossibility of making alterations too often on one spot in a copper plate.

The geographical change in the variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles. The variation chart should be consulted on this head.

Use of Oil for Modifying the Effect of Breaking Waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows :—

1. On free waves, *i.e.*, waves in deep water, the effect is greatest.
2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain ; as nothing can prevent the larger waves from breaking under such circumstances ; but even here it is of some service.
3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use ; crude petroleum is serviceable when nothing else is obtainable ; but all animal and vegetable oils, such as waste oil from the engines have great effect.
4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
5. It is useful in a ship or boat, both when running, or lying to, or in wearing.
6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.
7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.
8. The best method of application in a ship at sea appears to be : hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat which would follow with a bag towing astern, would appear to be the best plan. As before remarked under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

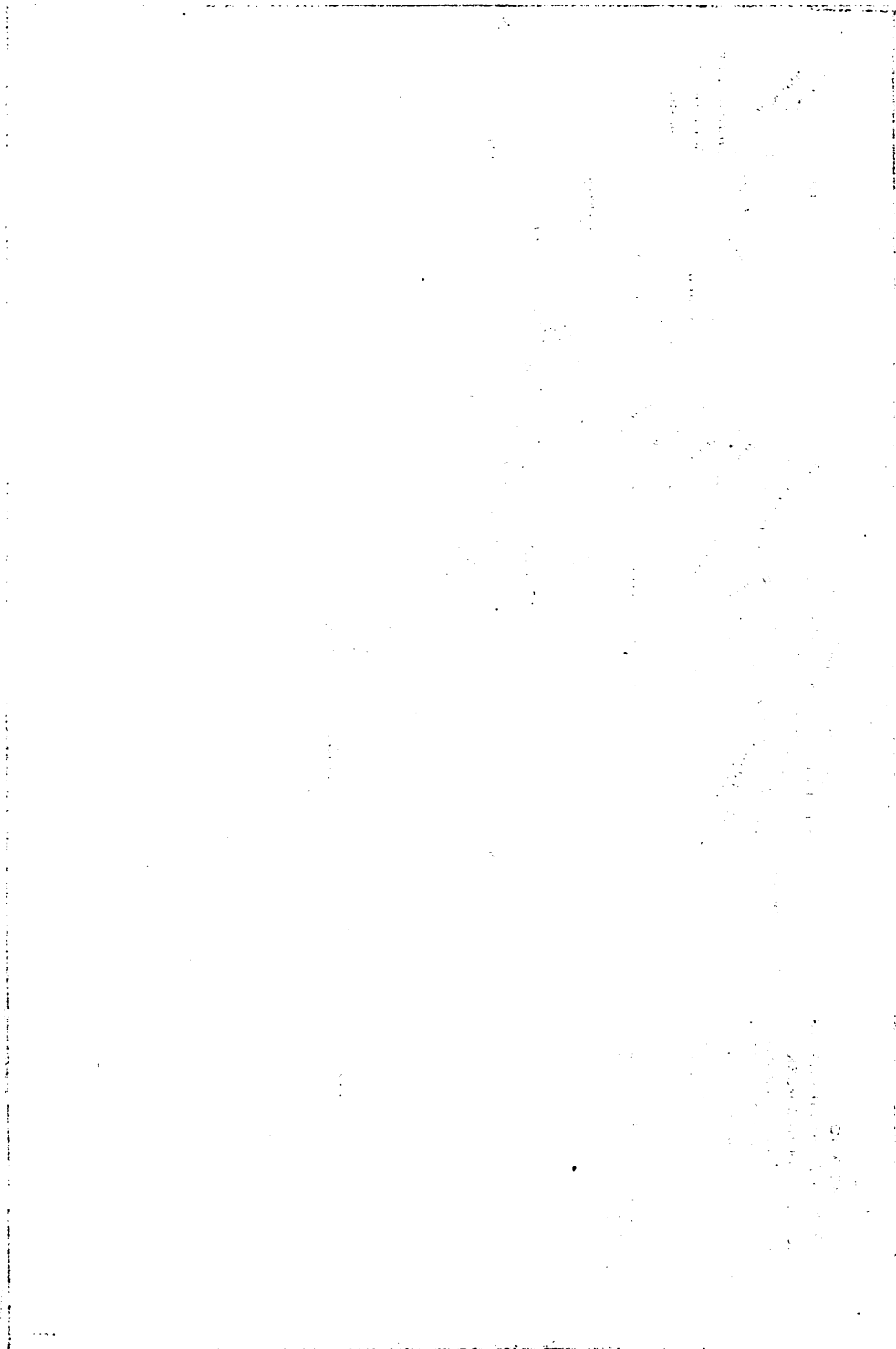
Local Magnetic Disturbance of the Compass on board Ship—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship in which it is placed. Observation shows that disturbance of the compass in a ship afloat is experienced only in a few places on the globe.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases, that it would require a local centre of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centres near together.

The law which has hitherto been found to hold good as regards local magnetic disturbance is, that north of the magnetic equator the north end of the compass needle is attracted towards any centre of disturbance, and south of the magnetic equator it is repelled.

It is very desirable, that whenever a ship passes over an area of local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.



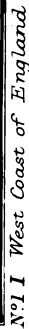
ADMIRALTY PUBLISHED CHARTS

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A number against a place thus Sally 1:34 shows that a separate plan is published bearing that number.

*A number and star thus 2383 * shows that a plan of the place is published on a chart or sheet of plans bearing that number. — For details of scales, prices &c see Admiralty Catalogue.*

Also shown on general Charts of the Irish Channel 1824^a and 1825^b and on Charts of English Channel 2675^c and 598.



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SAILING DIRECTIONS
FOR THE
WEST COAST OF ENGLAND,
FROM THE
SCILLY ISLANDS TO THE MULL OF GALLOWAY.

CHAPTER I.

APPROACHING THE BRISTOL AND ST. GEORGE'S
CHANNELS.—WINDS.—TIDAL STREAMS.—UNIFORM
SYSTEM OF BUOYAGE.—SCILLY ISLANDS.

Where the IRISH CHANNEL is referred to in this work, it applies to the whole of the channel separating Great Britain from Ireland. ST. GEORGE'S CHANNEL is that portion of it lying between the Tuskar and Holyhead island; the IRISH SEA that between Holyhead island and the Mull of Galloway; and the NORTH CHANNEL that between the Mull of Galloway and the Mull of Kintyre (Cantyre), and the coast of Ireland.

GENERAL REMARKS.—When approaching the Bristol or St. George's channels from the Atlantic, no opportunity of ascertaining and of progressively correcting the ship's position by astronomical observations should be neglected. Fogs, bad weather, and the long nights of winter frequently render it impossible to obtain a position by these means, in which case the approach to these channels should be made with extreme caution, as under such circumstances the course steered, the log, lead, and nature of bottom are the seaman's only guides.*

Use of the Lead.—It should ever be borne in mind when approaching the land, that, even under the most favourable circumstances of wind and weather, the frequent use of the lead is desirable; but *when a knowledge of the ship's position is dependent on dead reckoning, the lead becomes of primary importance, and its constant use indispensable to safe navigation.* It is true that the soundings

* See Admiralty charts, British islands, No. 2; English channel, No. 1,598 and 2,675a; Bristol channel, No. 1,179; Coasts of Ireland, 1,824a and b, and Irish channel, 1,825a and b; Also, Channel Pilot, part I., and Sailing Directions for the coast of Ireland, part I.

in very deep water cannot be depended upon as absolutely exact, but experience has proved that the depths may generally be trusted within two or three fathoms. Many vessels, neglecting to sound, have run on, unconscious of their position, until actually in positions of extreme peril; and instances are only too common where such neglect has resulted fatally to ships and crews among shoals in Cardigan bay and similar places.

It must not be supposed that a single cast of the lead is sufficient. A single cast may indeed confirm error, and become a fruitful source of danger, as the decrease in the depth of water, as the coasts of the West of England are approached, is mostly too irregular, and the quality of the bottom not sufficiently distinctive in character, to admit of reliance being placed on it.

A continuous line of soundings at known distances apart is therefore necessary when the position of the ship, out of sight of land, cannot be ascertained by astronomical observations; these being plotted and compared with those shown on the chart, will give increased confidence and lessen the possibility of mistake. Seamen would do well to bear in mind that the value of the lead is greatly enhanced by the frequency of its use. Southward, however, of the coast of Ireland westward of Cork, the irregularities in the bottom are so great as to prevent any reliable position being found by this means. Currents and tides, *see* p. 13.

Banks of soundings in the Approach.—From the Scilly Bishop light, the 50 fathoms line of soundings trends directly across the approach to the Bristol channel, to the Smalls, a distance of 113 miles. Northward of lat. $51^{\circ} 15' N.$, this depth marks the eastern edge of a lane of deep water 20 miles in breadth, extending from about 40 miles south-westward of the Smalls to about 30 miles north-eastward of it. In this lane the depths are from 55 to 63 fathoms, mud (ooze), whilst westward of it, on the Nymphe bank, the depths are from 36 to 46 fathoms with a bottom of sand, shells, gravel, or small stones; eastward of the lane the depths are under 50 fathoms, with a bottom of dark reddish sand, which is said to be the special indication of an approach to the Bristol channel. This lane of deep water might prove of considerable value to the navigator in thick weather, and when uncertain of his position; and is again referred to in the directions for approaching St. George's channel, page 7.

Nymphe bank, with depths of less than 50 fathoms, fronts the whole of the south coast of Ireland, its apex extending southward to lat. $51^{\circ} 5' N.$, or about 60 miles southward of the entrance to Waterford. The bank is said to abound with fish.

Labadie bank, with a least known depth of 34 fathoms, in lat. $50^{\circ} 35' N.$, long. $8^{\circ} 4' W.$, and deeper water close to, lies about 72 miles south of the entrance to Cork. It is apparently about 20 miles in length, in an east and west direction, by 3 miles or less in breadth. The nature of the bottom on the bank is fine white sand with red and black specks, whilst in depths over 60 fathoms around the bank it is grey sand and mud. On account of its narrowness, it is scarcely probable that a vessel would be able to verify her position in thick weather by getting a cast of the lead on it.

APPROACHING THE BRISTOL CHANNEL.

STEAM VESSELS approaching the Bristol channel from the westward should make the Fastnet, which lies directly in the track, whence they may shape course to pass northward of Lundy island, guarding against indraught on the flood to the Irish channel. Lundy is high and bold, with no dangers beyond half a mile from its extremes (except Stanley bank, of $4\frac{1}{2}$ fathoms, to the north-eastward), and its lights are visible in clear weather from a distance of 28 to 30 miles. From thence, course may be shaped to the desired port. The tidal streams set fairly in and out of the Bristol channel eastward of long. $5^{\circ} W.$ (*See tides*, p. 14.) Pilot boats and tugs are usually met with in the neighbourhood of Lundy island. (*See page 21.*)

In thick or foggy weather there is no danger in approaching Lundy island at slow speed if soundings are continuously taken, and the rocket fog signal will probably be heard at some distance. Soundings of 30 fathoms will be found at about 5 miles westward of the meridian of the island, and if approaching on the parallel of the island, soundings of 8 to 18 fathoms, sand, will be struck on North-West bank at from 2 to 4 miles westward of the island.

If neither Lundy island nor any other fog signal be heard when about 5 miles within the 30 fathoms line of soundings, the vessel will probably be northward of Lundy; but even if to the southward, she may still proceed eastward without danger, provided she does not shoal the water to less than 20 fathoms, but eastward of this depth extreme caution is necessary. If well to the northward, the fog signals from either the Helwick or Scarweather light-ships may be heard, but if the position cannot be ascertained it will be better to anchor, bearing in mind that the vessel is in the track of shipping, and keep the fog signal going. Fleets of colliers and other craft leave the docks of the Bristol channel ports nearly every high water.

In entering the Bristol channel towards the north side, bound to Milford Haven, or the ports eastward of it, care must be taken that the indraught (on the flood) to St. George's channel does not set the vessel northward of the Smalls. The stream (as stated on page 15) sets towards Liverpool whilst the water is rising there, and *vice versâ*, and from $3\frac{1}{2}$ to 4 knots an hour at springs. Southward of the Smalls the ebb from St. George's channel sets in a broad curve, south-eastward, into the Bristol channel, past Milford Haven; the flood to St. George's channel sets in the reverse direction. The ebb from St. George's channel is the flood stream in the Bristol channel, and *vice versâ*.

SAILING VESSELS are recommended to enter the Bristol channel on about the parallel of Trevoze head, $50^{\circ} 30' N.$, so as to counteract the north-westerly and northerly excess of stream which prevails in the approach; this promontory, lying nearly midway beyond Lands End and Hartland point, projects considerably beyond the general line of the adjacent coast, and, being high and steep, and furnished with a light visible from a distance of 20 miles in clear weather, is an eligible landfall from whence a vessel may with confidence shape a course up the Bristol channel. On this parallel the 100 fathoms line will be struck in about long. $10^{\circ} 45' W.$, and the 50 fathoms line when due north of the Scilly islands, or about 30 miles beyond the range of Trevoze light.

At the distance of 55 miles W.N.W. from Trevoze head, the bottom changes to coarse hard ground, and the water then shoals gradually to 35 fathoms at about 20 miles from the shore. The land may, however, be safely made on any parallel between Trevoze head and Hartland point, care being taken to keep outside the line of the heads, and at night not to go into a less depth than 30 fathoms. Having identified the land, a course may at once be shaped for Lundy island (in the neighbourhood of which tugs and pilot boats will usually be found), thence for the intended port.

Tugs, &c.—*See* p. 21.

Ground Swell.—In the approach to the Bristol channel there is always a ground sea or swell setting in from about W.N.W., unless easterly winds have long prevailed. The undulation is greatest with S.W. and S.S.W. winds, but as its direction is generally from W.N.W., its effect is to impel a vessel towards the Cornish coast, or into Barnstaple bay, on the Devonshire coast. Above Morte point, however, the height of the swell becomes sensibly diminished.

Caution.—It is worthy of remark that with the wind to the westward of South there is scarcely a safe roadstead for a sailing vessel

between the Lands End and Flatholm island in the Bristol channel, with the exception of Lundy and Clovelly roads, *see* pages 55, 57 ; nor are any of the others very secure with the wind to the southward of S.E., for though the wind be off-shore, it is nearly always accompanied by a heavy swell, and in the event of a shift of wind, which is almost invariably to the westward, the sea makes before a vessel can weigh and work out. For this reason, sailing vessels, during south-east gales, hugging the Cornish coast, should, on the first sign of the wind shifting to the westward, from which direction it will invariably blow harder, seek a good offing ; such names as Doom bar and Hell bay (now rendered Hayle) near Padstow, are suggestive of the fate of a sailing vessel after she is embayed. Should such a misfortune happen, the crew should stick to their ship, as, with the many life saving appliances established along the coast, there is every chance of being saved ; there is little or no chance of saving life by taking to the boats, owing to the heavy and confused sea, and which at times renders even lifeboats unmanageable.

Refuge anchorage under Lundy.—In westerly gales it might be prudent to seek shelter under Lundy island, where there is good anchorage, there being no ports available in the Bristol channel until after half flood. Outward-bound vessels will avoid much wear and tear by taking shelter here until the gale has subsided. (*See* pages 52, 55 for full details.)

APPROACHING THE ST. GEORGE'S CHANNEL AND IRISH SEA.

STEAM VESSELS approaching St. George's channel from the Atlantic should make the Fastnet, thence keeping in sight of the Irish coast, or in not less than 30 fathoms water to the Coningbeg light-vessel, and in 35 fathoms to the Tuskar light, from whence, if bound to Liverpool, course may be shaped to the South Stack and Skerries lights, and thence to the North-West light ship. *See* directions for approaching Liverpool, pp. 296, 344.

Caution.—In shaping course from the Tuskar to the South Stack and Skerries, or *vice versá*, it must be borne in mind that the course is diagonally across the set of the stream, and due allowance accordingly made. These diagonal courses involve a departure from the fairway course of the channel and from the direction of the main stream of tide ; yet it has often happened that a vessel so steering has been considered as stemming the tide, whereas, by receiving the adverse stream on the bow, she has been embayed in Cardigan or Carnarvon bays on the Welsh coast when proceeding northward, or

found herself amongst the Arklow or Blackwater rocks when proceeding in the opposite direction.

The stream throughout St. George's channel and Irish sea turns practically at the time of high water at the entrance to Liverpool, or 18 minutes before the time given for Liverpool in the tide tables, running to the northward or towards Liverpool when the water is rising there, and *vice versa*, with a velocity of $1\frac{1}{2}$ to $3\frac{1}{2}$ knots an hour in the fairway; these rates will assist or retard a vessel on the fairway course from 6 miles at neaps to about double that amount at springs during one ebb or flow. The strength of these streams is much increased and the direction altered near prominent headlands and banks, notably, the Tuskar, Arklow banks, eastward of the Smalls, Bishop, Bardsey, South Stack, and Skerries, ranging from 4 to 6 knots an hour, requiring increased caution when navigating in their vicinity. The direction of these streams are shown on the charts; see also the tidal streams described in detail, pages 15-17.

In thick or foggy weather, and uncertain of the latitude, by not standing into less than 30 fathoms, vessels will pass about four miles southward of Coningbeg light vessel, and a depth of 35 fathoms will keep them two miles south-eastward of the Tuskar, at which distances the fog signals will probably be heard, when course may be shaped up the St. George's channel as before. The nature of the bottom westward of Hook point (Waterford approach) is generally coarse, a mixture of stones, gravel and broken shells; between the Hook and the Coningbeg it is dark sand; when the sand becomes mixed with yellow specks, the vessel is probably eastward of the Coningbeg.

SAILING VESSELS are recommended to approach St. George's channel from well to the southward, between the parallels of $50^{\circ} 30'$ and $51^{\circ} 0'$ N., so as to counteract the northerly excess of stream which prevails in the approach. From about the meridian of Cork, and in depths of 55 to 60 fathoms, fine gray sand, or mud, or in the hole northward of Labadie bank, p. 3, possibly 65 fathoms, course should be shaped to pass well clear of the Tuskar, thence, as the wind permits, to the desired port. The action of the streams in St. George's channel on a course shaped from the Tuskar to the Stack has been described in the preceding directions for steam-vessels. See also the tidal streams, p. 15, and Ireland, part I.

Tugs, &c.—See p. 21.

In thick and foggy weather, and approaching on the parallel recommended, sailing vessels should take a continuous line of soundings, which will afford a good approximation of the position.

A depth of about 50 fathoms, gravel and shells, will be found on the parallel of $51^{\circ} 10' N.$, in long. $7^{\circ} 30' W.$, thence steering north-eastward to pass between the Tuskar and Smalls, depths of 50 to 40 fathoms, sand, gravel and shells, will be carried across the Nymphe bank for a distance of about 60 miles, until near its eastern edge, where the water deepens rapidly to 60 fathoms, mud (ooze) bottom. This is a sure indication of being on the western edge of the lane of deep water lying between the Nymphe bank and the Smalls, when course may be safely altered to pass eastward of the Tuskar and into St. George's channel for the desired port. The Smalls might also be safely made, by making for the eastern side of the lane of deep water, in about 50 fathoms, reddish sand; thence steering about N.E. $\frac{1}{2}$ E. and occasionally deepening the water to 55 or 60 fathoms, mud, the vessel will pass from 2 to 3 miles westward of the lighthouse; there being a depth of 50 fathoms at $1\frac{1}{2}$ miles west, and 60 fathoms at 4 miles west of it; at the first-mentioned distance the fog signals would probably be heard. The continuous use of the lead is imperative.

Harbours of Refuge.—It has been recommended that safety should be sought in good sea room rather than in harbours of refuge, but the condition of a ship may be such as to render it impossible to follow that precept. On approaching St. George's channel with a disabled ship, before entering it there remains a choice of two harbours of refuge, viz., Waterford or Milford, the former a bar harbour, with only 12 feet at low-water springs, and requiring half-tide for a ship drawing 15 feet to enter, if any sea is running; the latter free from outlying dangers in its approaches, and accessible at all times of tide. After entering St. George's channel no port of refuge is reached until in the neighbourhood of Kingstown or Holyhead, the former to be obtained only by a proper regard for the Arklow, India, Codlin, and Kish banks; the latter is by far the more easy of access. See page 287. In desperate necessity and in hope of saving life in a sinking ship, the nearest beach would naturally be sought; yet in such urgent need, or in the event of a ship being entangled in certain vicinities, it may be useful to name Wexford South bay, on the coast of Ireland, and St. Tudwall's roads (page 265) on the coast of Carnarvon, as capable, according to circumstances, of affording anchorage. A good seaworthy ship, if entangled in Cardigan bay, or among the shoals lying to the north-westward of the Tuskar, would find it difficult in bad weather to contend with the strong tidal streams that rush round Carnsore point, or

through Bardsey sound, and in its vicinity ; yet in such or any more desperate case, acceptable shelter might be found in those places.

NORTH CHANNEL (Northward of Ireland).—To steam vessels, and sailing vessels with a fair wind, navigating in the fairway, the channel northward of Ireland presents no difficulties, it being well lighted, and the dangers, most of which lie near the coast, are marked. This channel during the summer months offers a somewhat shorter route to and from Canada and the United States, and is available for outward-bound sailing vessels when southerly winds prevent their using the St. George's channel. North channel is scarcely available for sailing vessels during contrary winds, as, being but 11 miles wide between Fair head and the Mull of Cantyre, the tidal streams run with considerable strength, namely, with a velocity of three knots in the fairway, to 4 knots off Torpoint and Fair head, and 5 knots near the Mull of Cantyre, with heavy overfalls off the headlands, and over patches of uneven ground in the channel. The tidal stream runs towards Liverpool whilst the water is rising there and *vice versâ*, turning about 18 minutes before the time of high and low water there, as given in the Admiralty tide tables. Between the Isle of Man and the coast of Ireland there is no tidal stream, but southward of this space the direction of the stream partakes of both the North channel and St. George's channel streams. See tidal streams, pages 16, 17, and Ireland, parts I. and II.

Sailing vessels proceeding to sea through the North channel, after passing Tory island, should not be too anxious to make southing, but, if practicable, steer well to the westward, to avoid the indraught on the west coast of Ireland ; the prevailing westerly wind causes it also to be a lee and dangerous shore.

In thick or foggy weather, vessels must trust to a good look out and to the fog signals, as the soundings afford but little guide to the position.

Harbours of Refuge.—Sailing vessels meeting with adverse winds, or with bad weather coming on, will find good shelter in lough Foyle and Belfast, on the Irish coast, and loch Ryan, Campbellton, and Lamash, on the Scotch coast, but the Irish coast is to be preferred, as vessels with the prevailing south-westerly winds can easier get to sea.

WINDS.

The prevailing winds in the Bristol and Irish channels are westerly, and they greatly preponderate over those from the eastern half of the compass. From October to March inclusive, gales from the westward are most frequent and often last three or four days ;

during May, June, and July they are comparatively rare. In a S.W. gale, when accompanied by rain, the wind blows in violent gusts, and sometimes veers suddenly to N.W., North, or even N.E. without losing strength; should the wind continue from the northward with a rising barometer, its force usually moderates and the weather becomes fine; but, should it back to the S.W. with a falling barometer, bad weather is sure to return. It has been remarked that gales which occur during spring tides are generally more violent and last longer than those which take place during the neaps, and that they acquire their greatest strength at the beginning of the flood.

Winds from North to N.E. are sometimes strong, but they do not usually last so long, nor does the wind shift as with those from the westward. They cause a heavy sea at times, on the flood stream, and during their continuance the land is generally covered with a white fog resembling smoke; an appearance common during all easterly winds which sometimes when of moderate force blow with great persistence.

S.E. winds accompanied by rain and a falling barometer, almost always become gales, during which the changes of wind are very varied. Gales on our coasts being mostly of a cyclonic character and travelling from westward to eastward, the change of wind from S.E. depends on whether the position is northward or southward of the track of the storm's centre. If southward of it, the wind veers from S.E. to South and West; if northward, it backs to East and North. Seamen should bear in mind the well known rule for ascertaining the position of a storm's centre when in the northern hemisphere, viz.,—to face the wind, when the centre will be eight points to the right of its direction. Careful attention to the barometer and to any changes in the direction of the wind gives a sure clue to future probable changes. See Gale tables, pages 10, 11.

Moderate winds from N.W. to N.E. bring fine weather.

During summer, regular land and sea breezes frequently become established in fine settled weather; at night it then falls calm and a heavy dew ensues. When there is little or no dew it is a sign of an impending change of weather.

Calms are of rare occurrence even in summer, and do not last long. In winter they are generally precursors of bad weather, of which there are no more certain indications than swell in the offing and surf on the coast during a calm.

Snow.—In some winters snow is abundant; the wind is often fresh and baffling in snow squalls, and the falling snow effectually

obscures all objects from view. After a snow shower there is often great difficulty in recognizing the coast which may be in sight, the snow completely altering its aspect.

A change from rain to hail often accompanies sudden changes in the direction of the wind from a southerly to a more northerly point.

GALES.—The following tables of gales have been compiled at the Meteorological Office, London, from data extending over a period of 15 years, from 1871 to 1885. *See Storm signals, page 12.*

The district England, south-west, extends from Portland Bill to Milford Haven; and district Irish channel, from Milford Haven to Mull of Galloway, and Donaghadee to Waterford.

A gale is a wind blowing either with a force of not less than 8 (Beaufort scale), or a velocity of 40 miles an hour or upwards; and no gale is here recorded that was not felt at half or more than half the stations in the district. These amount to 22 in England, south-west district, and 18 in Irish sea, whereas the number of gales which prevailed irrespective of extent of coast affected, amounted to 37 and 43 respectively.

As regards direction, gales are grouped into four quarters, viz:—

North-Easterly	or gales from between N. and E. by N.
South-Easterly	„ „ E. „ S. by E.
South-Westerly	„ „ S. „ W. by S.
North-Westerly	„ „ W. „ N. by W.

GALE TABLE I.—TOTAL NUMBER OF GALES EXPERIENCED DURING EACH MONTH FROM 1871 TO 1885.

MONTH.	England, S.W. Portland Bill to Milford Haven.					Irish Channel. Milford Haven to Mull of Galloway, and Donaghadee to Waterford.				
	Direction.				From all Directions.	Direction.				From all Directions.
	N.Ely.	S.Ely.	S.Wly.	N.Wly.		N.Ely.	S.Ely.	S.Wly.	N.Wly.	
January	1	8	7	15	51	2	4	31	12	49
February	3	9	8	8	38	3	7	9	7	26
March	3	7	12	11	33	4	3	8	12	27
April	3	6	7	3	19	2	4	2	1	9
May	—	—	3	4	7	—	—	3	1	4
June	—	1	4	2	7	—	1	1	1	3
July	—	—	1	2	3	—	—	2	1	3
August	—	1	7	7	15	—	1	5	3	9
September	1	3	11	6	21	1	2	9	5	17
October	2	8	18	14	42	3	8	15	11	37
November	6	4	22	20	52	3	2	26	13	44
December	2	4	20	14	40	1	5	23	8	37

GALE TABLE II.—MEAN NUMBER OF GALES EXPERIENCED
DURING EACH MONTH FROM 1871 TO 1885.

MONTH.	England, S.W. Portland Bill to Milford Haven.					Irish Channel Milford Haven to Mull of Galloway, and Donaghadee to Waterford.				
	Direction.				From all Directions.	Direction.				From all Directions.
	N.Ely.	S.Ely.	S.Wly.	N.Wly.		N.Ely.	S.Ely.	S.Wly.	N.Wly.	
January -	0·1	0·5	1·8	1·0	3·4	0·2	0·3	2·1	0·8	3·4
February -	0·2	0·6	1·2	0·5	2·5	0·2	0·5	0·6	0·5	1·8
March -	0·2	0·5	0·8	0·7	2·2	0·3	0·2	0·5	0·8	1·8
April -	0·2	0·4	0·5	0·2	1·3	0·1	0·3	0·1	0·1	0·6
May -	—	—	0·2	0·3	0·5	—	—	0·2	0·1	0·3
June -	—	0·1	0·3	0·2	0·6	—	0·1	0·1	0·1	0·3
July -	—	—	0·1	0·1	0·2	—	—	0·1	0·1	0·2
August -	—	0·1	0·5	0·5	1·1	—	0·1	0·3	0·2	0·6
September -	0·1	0·2	0·7	0·4	1·4	0·1	0·1	0·6	0·4	1·2
October -	0·1	0·5	1·2	1·0	2·8	0·2	0·5	1·0	0·8	2·5
November -	0·4	0·3	1·5	1·3	3·5	0·2	0·1	1·7	0·9	2·9
December -	0·1	0·3	1·3	1·0	2·7	0·1	0·3	1·5	0·5	2·4

GALE TABLE III.—SUMMARY OF GALES SHOWN IN TABLE II.

Year or parts of a year.	England, south-west. Portland to Milford	Irish Channel. Milford to Mull of Galloway.
1. Average number of gales in one whole year	22·2	18·0
2. " " " during the 6 months from October to March, inclusive	17·1	14·8
3. " " " during the 6 months from April to September, in- clusive.	5·1	3·2
4. " " " during the most stormy period, November to January, inclusive.	9·6	8·7
5. " " " during the finest period, May to July, inclusive.	1·3	0·8
6. " direction of gales for one { North-easterly whole year, <i>i.e.</i> , the { South-easterly quarter from which { South-westerly they blow. { North-westerly	1·4 3·5 10·1 7·2	1·4 2·5 8·8 5·3
7. Severe gales included in the above, which reached a force of 10 (exceeding 60 miles an hour, over a large portion of the district).	6·8	6·3
8. Severe partial gales 	1·8	2·4

TABLE IV.—MEAN PRESSURE, TEMPERATURE, AND RAINFALL, FROM AVERAGE OF 15 YEARS (1871 TO 1885).

MONTH.	Barometer.			Thermometer.						Place.	Rainfall.
	Scilly Islands.	Milford Haven.	Isle of Man.	Scilly Islands.		Milford Haven.		Isle of Man.			
				Air.	Sea.	Air.	Sea.	Air.	Sea.		
	in.	in.	in.	°	°	°	°	°	°		in.
January -	29.91	29.88	29.82	46	49	44	46	41	44	Scilly islands -	45
February -	29.95	29.92	29.86	47	49	44	46	42	43	Padstow (near) -	60
March -	29.91	29.88	29.85	47	49	45	45	43	43	Cornish coast -	45-60
April -	29.94	29.93	29.90	50	50	49	47	48	45	Lundy island -	40
May -	29.98	29.98	29.95	53	53	53	51	50	48	Milford haven -	35-40
June -	30.01	29.98	29.94	58	57	58	55	56	53	Cardigan bay -	45-60
July -	29.95	29.96	29.90	61	60	61	58	58	57	Holyhead -	35-40
August -	29.96	29.94	29.88	62	61	60	60	59	59	Liverpool bay -	30
September -	29.95	29.92	29.87	59	59	56	60	55	59	Cumberland hills -	50-80
October -	29.87	29.96	29.82	55	56	53	57	51	55	Solway Firth -	40-45
November -	29.91	29.89	29.86	50	52	46	52	44	50	Isle of Man -	26
December -	29.95	29.91	29.86	47	51	44	49	42	46		
Mean for year.	29.947	29.921	29.88	53	54	51	52	49	50		

STORM SIGNALS are hoisted on information received by telegraph from the Meteorological Office, and are, if not subsequently directed to be lowered, kept up for 48 hours. A telegram is sent to most of the ports mentioned in this work, and it is usually posted up at the Harbour Office.

As weather information is only received at the Meteorological Office, at 8h. a.m., 2h. p.m., and 6h. p.m., a gale may have reached a station and passed on during the night, before the Meteorological Office is in a position to order the signal to be lowered.

These storm signals only refer to the greater and more general disturbances which may appear to be approaching. Local winds of gale force may occur for which no warning can be given, and observers must watch their own barometers, and local signs of weather.

The South cone (*a cone point downwards*) means that gales, or strong winds, are probable, at first from the southward (from south-east, round by south, to north-west). Should it appear likely that a gale beginning from between west and north-west is likely to veer northward or north-eastward, the North cone is hoisted in preference to the South cone.

The North cone (*a cone point upwards*) means that gales, or strong winds, are probable, at first from the northward (from north-west, round by north, to south-east). Should it appear likely that a gale beginning from between east and south-east is likely to veer

southward or south-westward, the South cone is hoisted in preference to the North cone.

Night signals.—Where storm signals are shown at night, three lights in the form of a triangle are exhibited in place of the cone.

Life saving appliances are kept at most of the coastguard stations. See Coastguard Stations, in the index.

CURRENTS.

General remarks.—As the most watchful efforts to obtain observations may fail, it is necessary, in shaping a course from the Atlantic for the Bristol or St. George's channels, to take into consideration the present and lately prevailing winds and weather, in order to make allowances for the set of the swell and influence of any probable current. This, however, requires great judgment, for the currents of these seas are mainly the prolonged movement of the water resulting from recent and possibly remote gales, and their actual direction may differ from the direction indicated by the run of the swell.

When, however, strong or long-continued westerly winds have prevailed westward of the northern coast of Spain, an outset from the Bay of Biscay may take place to the northward, which, after passing Ushant, has received the name of Rennell's current, and flows across the entrance of the English channel towards cape Clear. It is, however, pretty well established that this is only an occasional current so far as navigation is concerned, but as it may attain a rate of 1 or $1\frac{1}{2}$ knots an hour, the knowledge of its possible existence, coupled with the known strength of the tides, should induce great caution when approaching the land in thick weather.

TIDAL STREAMS.

General remarks.—A careful investigation of the tides in the Irish channel, the English channel, and in the North sea, has shown the possibility of referring the movements of the several streams to a common standard, instead of resorting to the troublesome process of comparing the motion of the streams with the varying times of high water along the coast.

For the entrance of the English channel and North sea the time of high water at Dover may be considered the standard; and for the whole of the Irish channel, the time of high water at the entrance of Liverpool. Liverpool low water may be used for the fairway of the Bristol channel as far eastward as Swansea, as the stream runs into the Bristol channel whilst the water is falling at Liverpool, and *vice versa*. The times of high water at Dover and Liverpool are almost identical.

Off the mouth of the English channel the stream, although much influenced by the indraft and outset of the channel, will

generally be found running to the northward and eastward while the water is falling at Dover ; and to the southward and westward while it is rising at that port. The particular direction given to the stream in this part of the sea by the meeting of the channel and of the offing tides will, however, be found in the Tide tables, Compartment I.* ; and it is only necessary to mention here, that to the southward of the parallel of Scilly, the tides of the channel and offing blend together with varying force and direction, and occasion the stream to be constantly changing, and in some places even to make the entire circuit of the compass in one tide, without ever remaining long upon any one point. So that any written description of their course is rendered almost impossible, and the table alone must be consulted for the direction at any particular hour.

BRISTOL CHANNEL AND APPROACHES.—General remarks.—Eastward of a line joining the Scilly islands and Tuskar, the set of the stream in the approaches to the Bristol channel, may readily be determined by referring to the state of the tide at the entrance to Liverpool, the stream setting eastward into the Bristol channel, whilst the tide is falling at Liverpool, and *vice versa*. Whilst the tide is falling at Liverpool the stream sets southward, out of the Irish channel, meeting the stream which sets northward during the same period, in about lat. 51° N., where both turn eastward into the fairway of the Bristol channel, and setting south-eastward on the northern side, and north-eastward on the southern side. The set is here stated in general terms to show that a strong indraught to the Bristol channel will always be experienced in the fairway of the Bristol channel, while the water is falling at Liverpool, and *vice versa*, and at about a mean rate of $1\frac{1}{2}$ knots an hour. For some distance westward of the line joining the Scilly islands and the Tuskar, the tides appear to be slack, but further observations are wanted.* Towards cape Clear the northern stream from Scilly apparently joins the southern and western stream from the Irish channel, and both to pass north-westward round cape Clear, and *vice versa*. •

South side.—The Seven Stones light vessel has been found, by many observations, to swing to the north-east or flood tide within a few minutes of the time of high water at Dover, which is practically the same as Liverpool, or 11 hours, full and change ; and at Trevoise head a few minutes later, and progressively later into the Bristol channel,

* From recent observations by Captain Aldrich, H.M. surveying vessel *Research*, whilst sounding the approaches to the English and Bristol channels ; the tidal streams between the parallels of 48° and 51° N., and the meridians of 7° and 11° W., are found to agree fairly with those given in the *West part of Compartment I.*, in the Admiralty Tide tables.

running parallel to the coast, and sharply round Trevoze head and Hartland point, with a velocity of 2 to 3 knots at springs, increasing gradually towards the head of the Bristol channel, where, in King road, it attains a rate of 5 knots. The stream turns off the coasts of Cornwall and Devon, and in the Bristol channel, eastward of Swansea, at high and low water by the shore, making a little earlier near the shore.

North side.—At the Smalls lighthouse it is slack water practically at the time of high and low water at the entrance of Liverpool (11 and 5 hours, full and change), or one hour before low and high water at the Smalls; the stream sets past the rock in a S. by W. $\frac{1}{2}$ W. direction while the water is falling at Liverpool, and N. by E. $\frac{1}{2}$ E. whilst it is rising there. The strength of the tide is sensibly felt hereabout, and all the way from the Smalls to Milford haven, running from $3\frac{1}{2}$ to 5 knots at springs. To the southward of the Smalls the stream sweeps round in a broad curve south-eastward, and enters the Bristol channel as a flood stream while the water is falling at Liverpool, and *vice versa*, as before stated.

Near the shore the streams make considerably earlier; the eastern stream off Milford haven, making at 9 hours full and change, or half ebb by the shore; and in Caldy roads at 9h. 40m., or $3\frac{3}{4}$ hours ebb by the shore. From the Mumbles, eastward, where the width of the channel is much diminished, the eastern stream makes at low water, and the western stream at high water by the shore, as on the south side of the Bristol channel.

On the Irish side, at the Saltees light-vessel, the water is slack about 20 minutes before it is high water at the entrance to Liverpool. The stream sets W.S.W. from a quarter of an hour before high water at the entrance to Liverpool to $1\frac{1}{4}$ hours after, and then W.N.W. until low water. The flood or rising tide at Liverpool sets past the Saltees for the first 3 hours E. by S., then E.S.E. for the 2 next hours, and S.E. by E. for the last hour, when the tide slacks, as before.

From the Saltees lightvessel to the Tuskar the stream sets along the land, but towards Carnsore point begins to tend to the northward on the flood, and finally sets sharply round that point into St. George's channel, and must be carefully watched by vessels in this locality.

IRISH CHANNEL.—The tide from the Atlantic enters the Irish sea by the St. George's and North channels; of which Carnsore point and St. David's head are the southern limits of the former; and Rathlin and the Mull of Kintyre the north-western limits of the latter.

Observations have shown that, notwithstanding the variety of times of high-water throughout the Irish channel, the turn of the

stream over all that part which may be called the fair navigable portion is nearly simultaneous; that the flood and ebb streams in both channels commence and end in all parts (practically speaking) at nearly the same time; and that that time happens to correspond nearly with the time of low and high water respectively on the shore at the entrance of Liverpool and of Morecambe bay,* a spot remarkable as being the point where the opposite tides coming round the extremities of Ireland terminate. So that it is necessary only to refer to the tide tables for the time of high and low water at either of these places, to determine the hour when the stream of either tide will commence or terminate in any part of the channel.

The central portion of the flood or ingoing stream, runs nearly in a line from a point midway between the Tuskar and the Bishops, to a position 16 miles due west of Holyhead, with a velocity of $1\frac{1}{2}$ to $3\frac{1}{2}$ knots an hour, northward of which it begins to expand eastward and westward; but its main body preserves its direction straight towards the Calf of Man, which it passes to the eastward with increased velocity as far as Langness point, and then at a more moderate rate on towards Maughold head. Here it is arrested by the flood or southern stream from the North channel coming round Ayre point, and is first turned round to the eastward by it, and then goes on with it at an easy rate direct for Morecambe bay; thus changing its direction nearly eight points.

The outer portions of the stream are necessarily deflected from the course of the great body of the water by the impediments of banks on the Irish side of the channel, and by the tortuous form of the coast on the Welsh. The eastern portion passing Linney head rushes with great rapidity between the Smalls, Grassholm, and Milford haven towards the Bishops, which it passes at a rate of between 4 and 5 knots; sets sharply round those rocks in an E.N.E. direction right over the Bass bank, and into Cardigan bay; makes the circuit of that bay, and sets out again towards Bardsey, at the other extremity of it; then sweeping about N. by W. past the island and through the Sound, it gradually takes the course of the shore, round Carnarvon bay, filling the Menai strait as far as Bangor; but the stream still continuing outside towards the South Stack, which it rounds, setting towards the Skerries at a rate of upwards of 4 knots; and finally turns sharp round those rocks for Liverpool and Morecambe bay; completing in its way the high water in the Menai, and filling the Dee, the Mersey, and the Ribble.

* The entrances of Liverpool and of Morcambe bay are 18 minutes earlier, in their times of high water, than those given for Liverpool in the tide-tables.

The western portion of the stream, after passing the Saltees, runs nearly in the direction of the Tuskar, sets sharply round it, and then takes a N.E. $\frac{1}{2}$ N. direction, setting fairly along the coast, but over the banks skirting the shore, so that vessels tacking near the inner edge of the sands on the flood, and on the outer edge of the ebb, have been carried upon them and lost, especially upon the Arklow and Codling banks. Abreast of the Arklow is situated that remarkable spot in St. George's channel where the tide scarcely either rises or falls. The stream, notwithstanding, sweeps past it at the rate of 4 knots at the springs, and reaches the parallel of Wicklow head. Here it encounters an extensive projection of the Codling bank; and while the outer portion takes the circuit of the bank, the inner stream sweeps over it, occasioning an overfall and strong rippling all round the edge, by which the bank may generally be discovered. Beyond this point the streams unite and flow on towards Howth and Lambay, growing gradually weaker as they proceed, until they ultimately expend themselves in a large space of still water situated between the Isle of Man and Carlingford. There another remarkable phenomenon occurs—the water rising and falling without having any perceptible stream. This space of still water is marked by a bottom of blue mud. Such is the course of the flowing water of the Irish channel.

IN THE NORTH CHANNEL the flood stream enters between the Mull of Kintyre and Rathlin island simultaneously with that passing the Tuskar into St. George's channel, but flows in the contrary direction. It runs at the rate of 3 knots at the springs, increasing to 5 knots near the Mull, and to 4 knots near Tor point on the opposite side of the channel. The eastern branch of this stream turns round the Mull towards Ailsa and the Clyde, a portion passing round Sanda up Kilbrennen sound and loch Fyne. The main body sweeps about S. by E., taking nearly the general direction of the channel, but pressing more heavily on the Wigtonshire coast; off which it has scooped out a remarkable ditch, upwards of 20 miles long by about a mile only in breadth, in which the depth is from 70 to 100 fathoms greater than that of the general level of the bottom about it. Near the Mull of Galloway the stream increases in velocity to 5 knots; the eastern portion turns sharply round the promontory towards the Solway, and splits off St. Bees' head, one portion running up the Solway, and the other towards Morecambe bay.

33 **The central portion**, midway between the Mull of Galloway and Copeland island, presses on towards the northern half of the

Isle of Man ; and while one portion of it flows towards Ayre point, the other makes for Contrary head, and is there turned back north-eastward at a right angle nearly to its early course. Passing Jurby point, it re-unites with the other portion of the stream and they jointly rush with a rapidity of from 4 to 5 knots round Ayre point, and directly across all the banks lying off there, and catching up the stream from the southward, off Maughold head, they hurry on together towards the great point of union, Morecambe bay. This bay, the grand receptacle of the streams from both channels, is notorious for its huge banks of sand, and also remarkable for a deep channel scoured out by the stream, and known as the Lune Deep.

The western portion.—There remains now only the western limit of the stream, which was left off Tor point running at a rate of 4 knots off the pitch of the point. Hence it strikes directly towards the Maidens, boiling over the Highlander and Russel rocks, and other reefs in the vicinity of that dangerous group ; and takes the direction of the Irish coast again from Muck island to Black head, at the entrance of Belfast lough, which it fills.

The ebbing or outgoing streams do not materially differ from the reverse of the flood, except that in St. George's channel they press rather more over towards the Irish coast.

Note.—These observations do not, however, extend beyond the points where the channels begin to open out, that is, beyond a line joining Rathlin and the Mull of Kintyre on the north, and the Saltees and Pembroke on the south. Outside of these limits, the waters diverge right and left ; that on the north joining the stream from Jura, and turning sharp round Rathlin ; that on the south (speaking now of the outgoing stream) sweeps past St. David's head into the Bristol channel on one side, and round the Tuskar, and past Waterford on the other.

FOGS are frequent in all parts of the Bristol and St. George's channels and the Irish sea. In summer they generally hide the land in the morning only and disperse as the sun acquires strength ; the moist haze accompanying westerly winds is more tenacious and only yields to a freshening breeze. It then frequently turns to rain, and marks the commencement of bad weather.

At Liverpool the average number of foggy days recorded is 28 days in a year.

Caution respecting Fog Signals at Lighthouses and Light Vessels.—The Trinity House, London, has given Notice, that, having in view the varying distances at which a fog signal can

be heard at sea, and the frequent occurrence of fog near to but not observable from a fog signal station :—

Mariners are cautioned that, whilst every endeavour will be made to start fog signals as soon as possible after signs of fog have been observed, they should not, when approaching the land in a fog, rely implicitly upon these fog signals, but should always use the lead, which, in nearly all cases, will give sufficient warning.

UNIFORM SYSTEM OF BUOYAGE.—1. The mariner when approaching the coast must determine his position on the chart, and must note the direction of the main stream of flood tide.

2. The term starboard hand shall denote that side which would be on the right hand of the mariner either going with the main stream of flood or entering a harbour, river, or estuary from seaward ; the term port hand shall denote the left hand of the mariner under the same circumstances.

3. Buoys showing the pointed top of a cone above water shall be called conical, and shall always be starboard hand buoys, as above defined.

4. Buoys showing a flat top above water shall be called can, and shall always be port hand buoys as above defined.

5. Buoys showing a domed top above water shall be called spherical, and shall mark the ends of middle grounds.

6. Buoys having a tall central structure on a broad base shall be called pillar buoys, and like other special buoys such as bell buoys, gas buoys, automatic sounding buoys, &c., &c., shall be placed to mark special positions either on the coast or in the approaches to harbours, &c.

7. Buoys showing only a mast above water shall be called spar buoys.

8. Starboard hand buoys shall always be painted in one colour only.

9. Port hand buoys shall be painted of another characteristic colour, either single or parti-colour.

10. Spherical buoys at the ends of middle grounds shall always be distinguished by horizontal stripes of white colour.

11. Surmounting beacons such as staff and globe, &c., shall always be painted of one dark colour.

12. Staff and globe shall only be used on starboard hand buoys ; staff and cage on port hand ; diamonds at the outer ends of middle grounds, and triangles at the inner ends.

13. Buoys on the same side of a channel, estuary, or tide way may be distinguished from each other by names, numbers, or letters, and where necessary by a staff surmounted with the appropriate beacon.

14. Buoys intended for moorings, &c., may be of shape or colour according to the discretion of the authority within whose jurisdiction

they are laid, but for marking submarine telegraph cables the colour shall be green, with the word "telegraph" painted in white letters.

Colouring of Buoys adopted on the West coast of England.—In carrying out the above Uniform system, the colours adopted by the Trinity House, London, are whole colours on the starboard hand, on entering, and parti-colours on the port hand. The colours adopted by the Mersey Dock and Harbour Board in Liverpool bay, are red on the starboard hand, on entering, and black on the port; *see* also p. 337.

Buoying and Marking of Wrecks.—15. Wreck buoys in the open sea or in the approaches to a harbour or estuary, shall be coloured green, with the word "Wreck" in white letters on them.

16. When possible the buoy shall be laid near to the side of the wreck next to mid-channel.

17. When a wreck-marking vessel is used she shall, if possible, have her top sides coloured green, with the word "Wreck" in white letters thereon, and shall exhibit,—

By day : Three balls on a yard 20 feet above the sea, two placed vertically at one end and one at the other, the single ball being on the side nearest to the wreck.

By night : Three white fixed lights similarly arranged, but not the ordinary riding light.

18. In narrow waters or in rivers, harbours, &c., under the jurisdiction of local authorities, the same rules may be adopted, or, at discretion, varied as follows :—

When a wreck-marking vessel is used she shall carry a crossyard on a mast with two balls by day placed horizontally not less than 6 nor more than 12 feet apart, and two lights by night similarly placed. When a barge or open boat only is used, a flag or ball may be shown in the daytime.

19. The position in which the marking vessel is placed with reference to the wreck shall be at the discretion of the local authority having jurisdiction.

LIGHT-VESSELS.—Riding lights.—For the purpose of showing in which direction the vessel is riding, a white light is exhibited from the forestay of each light-vessel, at a height of 6 feet above the rail. This regulation applies to all light-vessels under the jurisdiction of the Trinity House, London.

A watch buoy, painted red, with name of vessel in white letters, is moored near each light-vessel to mark the position in case of drifting.

Signals.—When a light-vessel is driven from her proper position to one where she is of no use as a guide to shipping, the following signals will be made, namely :—The usual lights will not be exhibited,

but a fixed *red* light will be exhibited at each end of the vessel, and a *red* flare shown *every quarter of an hour*. By day, the balls or other distinguishing mast-head marks will be struck. Also, that if from any cause the light-vessel be unable to exhibit her usual lights whilst at her station, the riding light only will be shown.

When from any of the light-ships, a vessel is seen standing into danger, a gun will be fired and repeated until observed by the vessel; also the two signal flags J. D. of the Commercial Code "*you are standing into danger*" will be hoisted and kept flying until answered.

The firing special rockets (of little sound but great brilliancy) immediately after a gun from a light-vessel will denote the need of assistance from the shore; rock lighthouses (excepting those in the Isle of Man) are also supplied with these rockets, for use when assistance is required from the shore.

Vessels are liable to a penalty of 50*l.* for fouling a light-vessel or a buoy; also to the cost of making good any damage so occasioned.

PILOTS AND STEAM TUGS.—Bristol Channel.—Pilots and steam tugs for the ports in the Bristol channel will be found in the neighbourhood of Lundy island, or in the anchorages under its lee. When Lundy affords no shelter, they will be found off Ilfracombe, about 20 miles farther in. Bristol pilot boats will be recognized by the numbers being on their bows, and without letters on the sails; these pilots are licensed by the Corporation of Bristol, and the pilotage above the Holms (Flatholm and Steepholm) is compulsory for merchant vessels. Cardiff pilot boats are mostly cutter-rigged, with the letters C^F in their mainsails; Swansea with the letter S. See sketches on chart, No. 1179, also remarks on pilots, at the ports affected. The signal for a steam-tug is the ensign whiffed at the peak.

St. George's Channel.—Liverpool tugs may be met with in the neighbourhood of the Smalls and Tuskar and under Bardsey island.

Lynus point (page 302) is the westernmost limit of the Liverpool pilot boats; these are fore and aft schooner rigged vessels, each vessel having her number on the sails and on each bow.

H.M. Ships are everywhere exempted from compulsory pilotage.

Lloyd's signal stations.—There is a Lloyd's signal station on the Scilly islands, and another on Lundy island* (see pages 24, 52), connected with the mainland by submarine telegraph cables; one has recently been established at the Calf of Man, page 434. The signal stations in connection with Liverpool, begin with the South stack, page 285.

* Lundy cable not in working order in 1890.

CHAPTER II.

SCILLY ISLANDS TO HARTLAND POINT.

VARIATION IN 1891.

Scilly islands - 20° 50' W. | Padstow bay - 19° 20' W.

SCILLY ISLANDS.*

General Remarks.—The Scilly islands and rocks in their vicinity occupy a space of about 47 square miles, and lie from 21 to 30 miles westward of the Lands End. The group consists of 48 islands, rented by Thomas A. D. Smith, Esq., lessee under the Duchy of Cornwall, who resides at Trescow. The ruins of the old Abbey at Trescow are well worth a visit, permission being first obtained from the proprietor. The principal town or settlement is on St. Mary's island. Capabilities, *see* harbours, page 24, and St Mary's road, the principal anchorage, page 26.

Five only of the islands are inhabited, viz., St. Mary's, St. Agnes', St. Martin's, Trescow, and Bryer, the population in 1881 being 2,315 ; of the others, 18 are capable of bearing grass ; the remaining 25 are barren ; the rocks above and below water are too numerous to admit of description. The chief exports are early potatoes and other vegetables, flowers, fish, and lobsters, many tons of which, to the value of from 10,000*l.* to 20,000*l.*, are annually shipped to London and Bristol. The imports consist of timber, coals, flour, bread, and general merchandize.

Landmarks.—The principal landmarks are the telegraph tower on the highest part of St. Mary's, the first object that appears above the horizon when approaching from the southward ; the Star fort, Lloyd's signal tower and flagstaff, also on St. Mary's ; the lighthouses on St. Agnes' island, Round island, and Bishop rock, and the red and white daymark on St. Martin's island.

* *See* Admiralty chart, Scilly islands, with views, No. 34 ; scale, *m*=3 inches, also No. 2565.

These may be seen in clear weather from a distance of 15 miles, and the lights from 18 to 20 miles.

Dangers.—A near approach to these islands from the south-westward or westward requires caution in hazy or thick weather, by reason of the rocky ledges which project in those directions, the principal of which are the Nundeeps, Crim, Bishop, Crebinack, Bishop's ridge, and the ledges westward of Pednathias head. The Crim, the westernmost danger of Scilly, has a rock 6 feet above high water, and the Bishop, southward of the Crim, has a stone lighthouse. The erection of this lighthouse now enables the mariner to approach from the south-westward with confidence. A little south-westward of the Crim and Bishop the tide runs strongly to the north-west, north, and north-east 8 hours out of 12. The south-eastern shores of St. Agnes', St. Mary's, and Menewethan islands, have no dangers beyond the distance of one-third of a mile, but eastward of St. Martin's sunken rocks extend about three-quarters of a mile off shore.

The Poll bank, a rocky ledge with 13 fathoms least water, lies nearly 3 miles S.W. $\frac{1}{2}$ S. from the Bishop light; the overfalls make it dangerous to open boats in rough weather.

Caution.—A depth of 55 fathoms will be found at about 12 miles westward and southward of the Bishop light. Vessels, in thick weather, are recommended not to approach the Scilly islands within the depth of 60 fathoms. The approaches to these islands are fully described in Channel Pilot, Part I.

LIGHTS.—Bishop rock.—From a circular gray granite lighthouse erected on Bishop rock, west extreme of the Scilly group, is exhibited at an elevation of 143 feet above high water, a *double flashing* white light, *every minute*, visible in clear weather from a distance of 18 miles. The two successive flashes are of about four seconds duration each, divided by an eclipse of four seconds. North-eastward of the group the light is obscured on certain bearings by the islands.

Fog signal.—During thick or foggy weather, an explosive fog signal gives one report (similar to the discharge of a gun), *every five minutes*.

St. Agnes'.—From a circular lighthouse, 74 feet high, painted white, on the summit of St. Agnes' island, is exhibited, at an elevation of 138 feet above high water, a *revolving* white light which attains its greatest brilliancy *every half minute*, and in clear weather is

visible from a distance of 18 miles. North-eastward of the group the light is obscured on certain bearings, by islands, *see* Chart.

Round island.—From a circular lighthouse, 63 feet high, painted white, erected on Round island, north side of Scilly group, is exhibited, at an elevation of 180 feet above high water, a *flashing red light of five seconds duration, every half minute*, visible in clear weather from a distance of 20 miles. Southward of the Scilly group the light is obscured on certain bearings by the different islands.

Pilots.—A licensed pilot cutter cruises south-westward of the Scilly islands; she is distinguished by the word *Lloyd's* painted on the weather boards, and by Lloyd's burgee at the peak. She is authorised to report vessels and to convey telegrams to the Scilly islands at a fixed tariff. There is a pilot's look-out on the summit of Bryer island. Pilots will come off to vessels from all sides of the group when signal is made for them, but there is little or no difficulty to steam-vessels entering St. Mary's road, by either St. Mary's or Broad sounds, with the aid of the chart.

HARBOURS.—The Scilly islands possess several harbours for vessels capable of taking the ground, and one anchorage (St. Mary's road), for vessels of deep draught; but the bottom among these islands, where not rocky, being generally of loose sand, is not tenacious, and on weighing, the anchors come home long before they are up and down. The best harbours are those of Old and New Grimsby, on the north side of the group, with depths of 4 to 5 fathoms; these are open to north-westerly winds, but afford secure anchorage during southerly gales, and to vessels that can take the ground. St. Mary's road affords shelter from all winds except those between W.N.W. and S.W., these, when strong, bring in a heavy sea, making the anchorage at such times an undesirable one.

Supplies.—Small supplies of general stores are obtainable at St. Mary's, and beef, mutton and poultry in small quantities.

Coal.—About 150 tons of coal are kept in stock at St. Mary's. Small craft coal alongside the pier, which has a depth of about 5 to 8 feet at the outer berth at low water springs; small quantities of coal can be brought alongside vessels in the road in lighters.

Communication.—There is regular communication by steamer with Penzance, three times a week in summer, and twice in the winter; average passage 3 hours.

Signal stations.—A Lloyd's signal station is established on St. Mary's island, with which vessels can communicate by the International code. It is connected by submarine cable with the mainland.

A signal station is established on Trescow island, for the purpose of communicating between the lighthouses, and with the Seven-stones light-vessel.

Lifeboats.—Coastguard.—A lifeboat and rocket station is established at St. Mary's island, and a lifeboat at St. Agnes. St. Mary's is the headquarters of a division of the coastguard.

ISLANDS.—St. Mary's island, the largest of the Scilly group, is 2 miles in length, $1\frac{3}{4}$ miles in breadth, and has an elevation of 128 feet. The little town of St. Mary's, consisting of over 200 houses, contains a market house, a church, two chapels, three schools, and has a resident clergyman who also serves St. Martin's. There are three very small building slips with blacksmiths' shops, several wells, and a tank capable of containing 3,400 gallons of water.

Pier.—The pier enclosing the harbour at St. Mary's has a depth of about 8 feet at its outer end, at low water springs, and 5 feet at 150 feet within; whence it dries gradually towards the shore.

Trescow island, nearly 2 miles in length, and three-quarters of a mile in breadth, contains 600 acres, has a church, national school, and resident clergyman. An ample supply of water is obtained from five wells in different parts of the island.

St. Martin's island, the north-easternmost of the group, is about $1\frac{1}{3}$ miles in length, and two-thirds of a mile in breadth; it contains 520 acres, about 140 houses, a church, and chapel.

Day-mark.—The most remarkable object on St. Martin's, is the Day-mark, 88 feet high, and painted with alternate red and white horizontal bands, which stands on the highest and eastern part of the island; its top is 185 feet above high water.

Bryer island is $1\frac{1}{2}$ miles in length, two-thirds of a mile in breadth, and attains an elevation of 133 feet. It contains 292 acres, three wells, and about 30 houses; there is a pilot's look-out on Watch hill, the highest point of the island.

St. Agnes' island, separated from St. Mary's by the Sound, is one mile in length by three-quarters of a mile in breadth; it contains 269 acres, including Gugh islet with which the island is connected by a narrow neck covering at three-quarters flood. The island contains a church, chapel, and has a resident clergyman; the people are supplied with good water from four wells. *See Light, page 23.*

Bishop rock, on which the lighthouse stands (page 23), is the highest of a cluster of rocks forming the south-westernmost of the dangers of the Scilly group. These rocks are about half a mile in extent, and covered at high water. The erection of the lighthouse

on this hitherto dangerous group of rocks enables the mariner to approach the Scilly islands from the south-westward with confidence.

Crim rocks are a cluster 6 cables in extent, north and south; of these the most conspicuous is the Peaked rock, 6 feet high, which lies $1\frac{1}{2}$ miles N. $\frac{1}{2}$ E. from the Bishop rock lighthouse. The passage between the Bishop and Crim rocks is upwards of one mile across and is the entrance to Broad sound, one of the many channels leading into St. Mary's road.

ST. MARY'S ROAD, lies to the westward of St. Mary's island; it affords shelter for a large number of vessels from all winds except those from between W.N.W. and S.W.; these when strong throw in a heavy sea rendering the anchorage unsafe at times. The depths in the anchorage range from 5 to 9 fathoms, with a light sandy bottom, not very good holding ground. A good position for light draught vessels, in about 5 fathoms, is with Nut island distant 4 cables, and in line with Hangman island. Deep-draught vessels anchor farther to the south-west. Vessels should either anchor with a long scope of cable, or moor with open hawse to the westward.

During westerly gales, light draught vessels, if necessary can, at high water, slip and run to leeward over Crow bar into Crow sound, p. 28, and anchor under St. Mary's island.

The Pool.—The eastern part of St. Mary's road, and the bay in which the town is situated, is known as the Pool. It contains many shallow heads of rock, two of which uncover near low water. The outer danger is named the Ridge and has a depth of 20 feet, with the castle bearing S. by W., distant about 4 cables. When the road is unsafe, the Pool affords shelter to a few small vessels; but a pilot should be employed. Boats can land at the pier at all states of the tide, there being a depth of 8 feet at low water at its extreme.

Woodcock ledge, on the east side of St. Mary's road, is about one cable in extent, with a least depth of 8 feet, and situated about 2 cables off the shore north-westward of the Castle; a patch of 19 feet named Trisky ledge, lies one cable south-west of the Woodcock.

Shallow water extends about $1\frac{1}{2}$ cables north-westward of Stevel point, west extreme of St. Mary's island, at which distance the depth is $3\frac{1}{2}$ fathoms, steep-to.

These shoals are not buoyed, but St. Martin's daymark open northward of Greeb rock leads north-westward of them. The dangers extending into St. Mary's road, southward and westward of Samson island, will be seen on the chart.

Entrances.—There are five distinct entrances to St. Mary's road, viz. :—St. Mary's sound, Smith sound, Crow sound, Broad sound and

North channel. Crow sound and Smith sound are intricate, and should not be taken without the assistance of a pilot. The other channels present little or no difficulty to a steam vessel or sailing vessel with a fair wind.

ST. MARY'S SOUND is the easiest entrance for vessels from the southward. The shoals are buoyed and the leading mark (View C on chart) is good and distinct. The depths are not less than 6 fathoms on the leading mark, but at low water springs, between Bartholomew ledges and St. Mary's, the channel with this depth is only half a cable wide.

Spanish ledges, about 2 cables in extent, with rocky heads on its eastern end which dry at low water springs, lie in the entrance to St. Mary's sound. A can buoy, chequered black and white, in 6 fathoms, is moored near the east extreme of the ledges, about 150 yards from the rocks.

Bartholomew ledges, situated about half a mile within Spanish ledges, is about 2 cables in extent within the depth of 3 fathoms, with some rocky heads which dry at low water springs; a can buoy, with black and white vertical stripes, in 7 fathoms, marks the north-east extreme of the ledges, at about 100 yards from the rocks.

Woolpack rock, situated $1\frac{1}{2}$ cables S.S.W. from Woolpack point, east side of St. Mary's sound, dries at the last quarter ebb. An iron beacon, with a ball, is erected on this rock.

Northward of the Woolpack, the coast of St. Mary's island is foul to the distance of $1\frac{1}{2}$ cables; this is referred to in the description of the Pool, St. Mary's road.

Directions.—Entering St. Mary's road by St. Mary's sound.—Approaching either from the eastward or westward, keep a good half mile off shore, until the leading mark, north-east part of Mincarlo is in line with the highest part of Great Minalto (View C on chart) bearing N.W. by N.; then steer in on that mark, passing north-eastward of Spanish ledge buoy, and between Woolpack beacon and Bartholomew ledge buoy. When St. Martin's daymark comes in line with Greeb rock (open of St. Mary's island) bearing N.E. by E. $\frac{1}{2}$ E., steer for Trescow island, anchoring as convenient. See St. Mary's road, page 26. The flood tide sets northward through St. Mary's sound from half ebb to half flood, and the ebb *vice versa*; the streams also set across the entrance, see tidal arrows on chart.

BROAD SOUND.—**Directions.**—Broad sound is the entrance to St. Mary's road from the westward. The channel is perfectly straight, 4 cables wide in its narrowest part, and presents no difficulties to a steam vessel or a sailing vessel with a fair wind; since the erection

of the Bishop light, the leading mark, Nornour islet, its apparent breadth open northward of Bants Carn (View B on chart) bearing E. by N., is easily picked up. This mark leads about 3 cables northward of Bishop rock lighthouse, about $1\frac{1}{2}$ cables from the nearest of the Bishop rocks, and between the black and white striped can buoy in 10 fathoms, placed nearly 2 cables southward of the Gunner ledges, and the black conical buoy on the north side of Old Wreck rock, direct to the anchorage in St. Mary's road. The flood tide sets about north-east, or across the line of the leading mark, and should be guarded against until eastward of Old Wreck buoy, thence it sets fair for St. Mary's road and through Crow sound.

NORTH CHANNEL.—Directions.—North channel is deep and three-quarters of a mile wide in its narrowest part, between Steeple rock, which is awash at low water springs, and Carnbase shoal, which has a depth of $2\frac{1}{2}$ fathoms.

It presents no difficulties to a steam vessel, but the set of the stream in the entrance is across the leading mark, the flood setting north-eastward and the ebb the reverse, and must be guarded against.

The leading mark is St. Agnes lighthouse in line with Great Smith rock, bearing S.S.E. $\frac{1}{4}$ E., until Nornour islet is its apparent breadth only open of Bants Carn E. by N. (View B on chart), when steer for this latter mark to St. Mary's road.

CROW SOUND.—Directions.—Crow sound, situated eastward of St. Mary's island, affords temporary anchorage with winds between West through north to about N.E., but would be untenable during southerly winds. The bottom is sand, and reported to be good holding ground. There are depths of 7 to 8 fathoms at a quarter to half a mile off St. Mary's island, abreast Watermill cove; and from 3 to 4 fathoms within Inisidgen island and the buoy southward of the Hats.

From the westward, keep half a mile off St. Mary's island until abreast Gap point, when round into the Sound. From the eastward, keep a mile off shore until the south extreme of Trescow island is in line with the north extreme of St. Mary's island, which leads southward of Trinity rock of $2\frac{3}{4}$ fathoms, thence to the anchorage abreast Watermill cove.

Crow bar, which separates Crow sound from St. Mary's road, has a depth of one foot at low water, 13 feet at high water neaps, and 17 feet at high water springs. An increased depth may be expected with westerly gales, but the channel, except in an emergency, should not be attempted without the assistance of a pilot.

Crow rock, on which there is a beacon, covers at 12 feet rise;

the depth on the bar at that time will be about 14 feet. The channel is northward of the beacon, and southward of the black buoy placed southward of the Hats. *See Chart.*

TIDES.—It is high water, full and change, at the Scilly islands at about 4h. 30m. local, 4h. 56m. Greenwich time; equinoctial tides rise 20 feet, ordinary springs 16 feet, and neaps 12 feet. During stormy weather, or after heavy gales from the southward, the tide flows about an hour longer; northerly winds keep it back.

The tides at about 6 miles southward of the islands appear to set straight, and to run for equal spaces of time eastward and westward; nearer to and among the islands and rocks they are subject to a variety of inflections and inequalities.

The flood from the south-west divides and sets round the islands on both sides, the two streams meeting again in the north-east, as indicated by the arrows on the chart.

Through St. Mary's sound the tide sets to the northward from half ebb to half flood, and to the southward from half flood to half ebb. The flood sets regularly through St. Mary's road from Broad sound, over Crow bar, and through Crow sound to the eastward; the ebb sets in the contrary direction, but is not strong.

Through the North channel, except near Steeple rock, the flood sets into St. Mary's road and the ebb in the contrary direction.

The tide coming in through Broad sound from the westward, sets through St. Mary's road, towards the eastern end of St. Martin's island, where, at 4 hours' flood, it meets the stream coming to the southward round St. Martin's head; this makes the race off Hanjague: and, this latter stream prevailing, sets away S.W. by S. as far as Menewethan island, where, being joined by the Crow sound stream running out S.S.E., it causes an extensive race during spring tides, and all the streams united go off southward together.

In New Grimsby harbour, the tide at low water runs in for one hour and a half, it then runs out for 3 hours, turns and runs in 4½ hours until half ebb, when it again turns and runs out the other 3 hours until low water. Between the islands of Samson and Bryer the tide runs in 8 hours from the westward, from low water, until 2 hours ebb, it then runs out westward until low water.

At half flood, the tide through New Grimsby harbour sets over the flats towards St. Mary's until half ebb; and, from St. Mary's road through New Grimsby harbour, from half ebb to half flood.

In Old Grimsby harbour, St. Helens pool, and Tean sound, the tide runs inwards 9 hours; from low water past high water, to half ebb by the shore; and outwards for 3 hours only, or from half ebb to low water.

Southward of St. Agnes' island there is an overfall occasioned by the confluence of the two streams of tide, between 4 hours flood and 2 hours ebb. This overfall is further augmented by the unevenness of the bottom over which it runs ; it sometimes extends as far seaward as 3 miles, but gradually subsides as the streams assimilate.

The SEVEN STONES are a cluster of dangerous rocks situated nearly in the fairway between the Scilly islands and the Lands End. They are one mile in extent, and covered at high water ; in rough weather the breakers upon them may be seen from a considerable distance. The highest and north-westernmost rock, named the Pollard, dries at half ebb ; the South Stone, the southernmost rock, situated S.S.E. about 6 cables from the Pollard, dries at two-thirds ebb ; and the northernmost rock, situated 2 cables north-eastward of the Pollard, also dries at two-thirds ebb. Sunken rocks also lie eastward of the Pollard, for a distance of 3 cables. From the Pollard, St. Martin's daymark bears W. by S. $\frac{3}{4}$ S., distant $7\frac{1}{8}$ miles, and the Longships lighthouse E. by S. $\frac{1}{4}$ S., distant 15 miles.

The Seven Stones are steep-to, there being depths of 38 to 40 fathoms at the distance of one mile, except to the south-westward ; here at the distance of one mile, and $1\frac{1}{4}$ miles from the Pollard, patches of 20 fathoms exist.

Clearing marks.—The telegraph tower on St. Mary's, seen between the hills of Great Granilly islet and open southward of the remarkable conical rock, Hanjague, bearing W. by S. $\frac{1}{2}$ S., leads half a mile south-eastward of the Seven Stones ; the telegraph tower, in line with east extreme of St. Martin, bearing S.W. by W. $\frac{1}{4}$ W., leads one mile westward of the Seven Stones.

LIGHT VESSEL.—The Seven Stones light-vessel exhibits at an elevation of 38 feet above the sea, a *white* light showing *three flashes* in quick succession followed by thirty-six seconds darkness, the whole period being *one minute*. The vessel is painted red, with the words *Seven Stones* on her sides, and carries a ball at the masthead. A gun is fired if a vessel is seen standing into danger, but vessels should not pass between the light-vessel and the Stones.

The vessel is moored in 39 fathoms, with the Pollard rock bearing W. by S., distant $2\frac{4}{10}$ miles ; the South Stone S.W. by W. $\frac{1}{2}$ W., distant $2\frac{4}{10}$ miles ; St. Martin's daymark W. by S. $\frac{3}{4}$ S., distant $9\frac{4}{10}$ miles ; and Round island light W. $\frac{3}{4}$ S., distant 11 miles.

Fog signal.—During thick or foggy weather a powerful siren trumpet gives *three blasts* in quick succession *every two minutes* ; the first blast is a low note, the second high, and the third again a low note.

Signal communication.—See Scilly signal stations, pp. 24, 25.

THE MAINLAND.—LANDS END TO HARTLAND POINT.

The **LANDS END**, or westernmost extremity of England, may be seen in clear weather at the distance of about 25 miles, and when first viewed from the southward and south-westward, has the appearance of two detached hummocks. On nearing the land another hummock, with buildings on it, appears to the westward; then cape Cornwall, and ultimately the whole forms a continuous line of coast. The most conspicuous objects in the vicinity of the Lands End are the steeples of Sennen and St. Buryan churches, 360 feet and 488 feet respectively, above high water.* The extreme of the Lands End is named Peal point.

LONGSHIPS ROCKS.—About one mile westward from Peal point, the extreme of the Lands End, is a group of detached rocks from 20 to 44 feet in height, named the Longships, on the largest and most elevated of which stands a lighthouse. Sunken ledges extend from a half to 2 cables beyond the high water rocks, the greater distance being south-eastward of Round islet, the southern rock.

At the distance of $6\frac{1}{2}$ cables N.E. by E. from the lighthouse lies Sharkfin rock, which dries at one-third ebb, and is steep-to, except off its south-west side, where a depth of 9 feet will be found at the distance of one-third of a cable. A shoal, named Ketelboton, lies E. by S., distant $5\frac{1}{2}$ cables from the lighthouse, and dries at one-quarter ebb; shallow water extends $2\frac{1}{2}$ cables south-west from it. Between Ketel-boton and Sharks-fin is Fe-les, a small rock, which dries at three-quarters ebb, with deep water around it.

LIGHT.—Longships lighthouse, on the highest rock (44 feet), is a circular tower of gray granite, from which is exhibited, at an elevation of 110 feet above high water, an *intermittent* light of the first order, suddenly eclipsed for *three seconds*, once every minute; it shows *white* seaward between the bearings of S.S.W. $\frac{1}{2}$ W. and N. by W. $\frac{1}{4}$ W.; *red* between the bearings of S.S.W. $\frac{1}{2}$ W. and S.W. $\frac{1}{4}$ S., also between the bearings of N. by W. $\frac{1}{4}$ W. and N.W. by N. A *red* light of less power is shown towards the land.

* See Admiralty charts :—Trevose head to Dodman point, including the Scilly islands, No. 2,565; scale, $m = 0.5$ of an inch; Manacle, Runnelstone, and Longships rocks, No. 2,473; scale, $m = 6.0$ inches.

The bearing S.S.W. $\frac{1}{2}$ W. leads half a mile westward of the Brisons, and the bearing N. by W. $\frac{1}{4}$ W. leads three-quarters of a mile westward of the Runnelstone.

In clear weather the *white* light should be visible from a distance of 16 miles.

Fog signals.—In thick or foggy weather a fog signal, consisting of two explosive reports (each sounding like the discharge of a gun), is fired *every ten minutes*; the interval between the two reports is about *five seconds*. A bell is sounded twice in quick succession every quarter of a minute when the fog signal is not available.

Tides.—It is high water, full and change, at the Longships at 4h. 35m. local, 4h. 58m. Greenwich time; springs rise 20 feet; neaps 14 feet.

Directions.—There is a channel half a mile wide within the Longships, between Ketel-boton and Peal point. It carries 8 to 11 fathoms water, but is only used by coasters. The leading mark through is the highest part of the northern Brison appearing westward of the highest part of the southern or lower Brison, bearing N.N.E.

WHITESAND BAY lies between the Lands End and cape Cornwall. The coast cliffs average 200 feet in height from Lands End to Peden Mean-du point; thence to Gwynver sands they vary from 190 to 20 feet, again rising to 300 feet towards cape Cornwall. Bounder rock, with $3\frac{3}{4}$ fathoms over it at low water, lies in the centre of the bay, about half a mile off shore, with Matthew's house in line with Sennen church, bearing S. $\frac{1}{4}$ W. Vessels ride well sheltered from easterly winds in 12 to 15 fathoms, with cape Cornwall bearing N.N.E. $\frac{1}{2}$ E., half a mile off this rock, but the danger arising from westerly winds causes Whitesand bay to be little frequented.

Sennen cove lies at the southern end of Whitesand bay, within Peden Mean-du point, where the seine boats are protected by Bo Colloe and Bo Col rocks, awash only at high-water springs. The Little Bo, or outermost rock, dry at half ebb, lies nearly one-third of a mile from the shore

Fishing light.—A small *fixed white* light for the use of the fishermen is established at Sennen cove, visible between the bearings of N.W. by W. $\frac{1}{2}$ W. through north to N.E. $\frac{1}{2}$ E.

Coastguard.—Lifeboat.—A lifeboat and rocket apparatus are maintained at Sennen cove, where is also a coastguard station; there is a detachment of coastguard at Porthleden, to the northward.

Cape Cornwall, the north extremes of Whitesand bay, is 197 feet high, and from it the coast, much indented, extends north-eastward $2\frac{1}{2}$ miles to Pendeen point, with cliffs of 50 to 100 feet in height; from a distance many of the intervening points appear like islands.

THE BRISONS are two rocky islets 90 and 71 feet above high water, lying W. $\frac{1}{2}$ S. half a mile from cape Cornwall, and N.E. $\frac{3}{4}$ N. $3\frac{1}{2}$ miles from the Longships lighthouse. The northern islet is the higher of the two. Between the Brisons and Polptry point are rocky ledges which dry at last-quarter ebb; the water is also shallow for nearly one cable S.W. by W. from the south Brison, and at the same distance in a W. $\frac{1}{2}$ N. direction is a small patch of 16 feet. The Brisons islets in line lead westward of the Greeb patches, extending from Polptry point; and Nanjulean mill seen open in the valley, bearing S.E. by E. $\frac{1}{4}$ E., leads southward.

The Vyneck, a group of detached rocks, dry at three-quarters ebb, lie one-third of a mile N.N.W. $\frac{1}{2}$ W. from cape Cornwall, with the Longships lighthouse touching the eastern shoulder of the small Brisons islet.

OFF-LYING BANKS.—Cape Cornwall bank is a rocky ridge about 3 miles long in a north-north-east and opposite direction, and half a mile broad within a depth of 20 fathoms. The least depth known is 12 fathoms, near its south extreme. Its north end is situated with Longships lighthouse bearing S. $\frac{1}{2}$ W., and Battery point S.E. by E. $\frac{1}{3}$ E.

Bann shoal is a rocky shoal lying about 5 miles north-eastward of cape Cornwall bank; it is about one mile in extent within a depth of 20 fathoms, with 8 fathoms on its shoalest part, from which Sennen church is in line with cape Cornwall, bearing S. by W., and Battery point S.E. $\frac{1}{2}$ S., distant $12\frac{1}{4}$ miles.

Caution.—As the sea breaks heavily in bad weather on both of these banks, particularly during north-west gales, their locality should at that time be avoided, especially by small and heavily laden vessels. The coast being so far distant, no good marks can be given for clearing them; but in proceeding from the Lands End northward, if the weather be clear, the Longships lighthouse kept on a S. $\frac{1}{2}$ E. bearing, will lead one mile westward of cape Cornwall

bank; the Brisons islets S. $\frac{1}{2}$ W., or at night the Longships light bearing S. by W., will lead between the shoals; cape Cornwall S. by W. $\frac{3}{4}$ W. will lead one mile eastward of Bann shoal.

Three Stone Oar rocks.—Between cape Cornwall and Pendeen point there are several dangers near the shore. Manver rock, dry at half-ebb, is two-thirds of a cable from Botallock head; and the Cokle Marny rock, which resembles a boat bottom upwards, lies one cable in a northerly direction from the head, also dry at half-ebb. The three rocks named the Skinvynecks, are $1\frac{1}{2}$ cables north-westward of Pendeen point; the two inner rocks dry at one-third ebb flood, and the outermost is awash at low water. The Three-stone-oar rocks, one-third of a mile north-eastward of Watch-hill (Pendeen) point, are just above ordinary high water springs; the passage between them and the point should not be attempted by a stranger. S.W. by W. three-quarters of a mile from the outermost of the Three-stone-oar rocks is Avarrack rock, dry at half-ebb.

COAST.—Pendeen cove.—Coastguard.—About one mile eastward of Pendeen point is Pendeen cove; here is a coastguard station, where a rocket apparatus is kept; there is a detachment of the coastguard at Treen cove to the eastward.

Mozen rocks, dry at three-quarters ebb, lie north-eastward of Pendeen cove at about 2 cables off shore.

Gurnard head, about 3 miles eastward of Pendeen cove, is 185 feet high, rugged, steep, and surrounded by a mass of detached rocks, the largest of which, the Ebal, lies one cable off the head, and is covered at high water springs. The same rugged coast continues from Gurnard head on to St. Ives, indented with cliffs varying from 50 to 250 feet in height.

Rocks.—Nearly one mile W.S.W. of the Ebal, and about 2 cables off shore, is a small rock, which dries one foot at low water springs; a patch of 3 fathoms lies about midway. The chief dangers are Carnellow shoal, one-third of a mile eastward of Gurnard head, having a depth of 3 fathoms, with Ebal rock bearing W. $\frac{1}{2}$ S.; and the northern house of Trereen farm in line with the old Mine chimney. Carnellow rock, with 6 feet water, lies one cable S.E. by E. of the shoal. Carlow rock, midway between Gurnard head and Carn Naun point, $2\frac{1}{2}$ cables from the shore, dries at first quarter ebb; the Caraks, about half a mile westward from Carn Naun point and 2 cables off shore, is a large mass of rocks, the largest of which is 25 feet above high water; the others are dry only at the last quarter

ebb. The coast between Pendeen cove and Battery point should be given a berth of half a mile.

ST. IVES BAY, lies between St. Ives head or Battery point, and Godrevy head, a distance of $3\frac{1}{4}$ miles in an east and west direction, from which line the bay has a depth of 2 miles.

Battery point, 104 feet above high water, has on its summit a pilot's watch-house and a battery of three guns. Very little of the town of St. Ives is visible until the head has been rounded, and then the most prominent objects are the square tower of its church, 90 feet in height, and some terraces on the high ground. It is backed by several hills, on one of which is Tregenna castle, formerly the seat of the proprietor, now held by the Great Western Railway Company as the Tregenna Castle hotel; on another is Knill's monument, an obelisk whose base is elevated 545 feet, whilst more to the south-eastward is the rugged summit of Trecrobben (Trencromb) hill, 590 feet above high water.*

The best anchorage is in 9 fathoms, stiff clay, with Battery point bearing N.W. $\frac{1}{2}$ W., and Knill's monument open eastward of Porthminster farm, S.W. $\frac{1}{2}$ W.; the bay however is completely exposed to northerly winds, which throw in a heavy sea, as do also westerly winds.

The Tidal harbour at St. Ives is about 6 acres in extent, and dries about 6 feet at low water springs; it has depths of 14 feet at high water springs, and 8 feet at high water neaps. At the extreme of the pier the depth is 21 feet at high water springs, decreasing towards its head. The harbour is formed by a stone pier, 166 yards in length, built in 1770, to which an addition of about 100 yards has been recently made. Some protection is afforded to this pier by a breakwater, 200 yards in length, constructed in 1867 seaward of it; its inner end, for about 60 yards, is of masonry, the remainder being of piles filled in with rubble. About 140 feet of the outer end has been broken away by successive gales, and the débris forms a half-tide reef, known locally as Fishermans reef.†

The bottom of the harbour is composed of sand, with a slight coating of shingle or ballast. There are large iron posts above high water for bow moorings, and two buoys with rings attached, for the purpose of making fast stern moorings; but on account of the ground swell, which is severely felt on this part of the coast, it is not an unusual occurrence for the moorings to give way and the

* See Admiralty plan of St. Ives bay, No. 1,987; scale, $m = 4.0$ inches.

† Information from Harbour Commissioners, February, 1889.

vessels to break adrift. The extension of the stone pier, as before stated, will probably lessen the swell in the harbour.

LIGHT.—From a stone lighthouse on the outer end of the inner or stone pier, is exhibited, at an elevation of 28 feet above high water, a *fixed* light, showing *red* through an arc of 66° , or from the bearing of S. 17° W. to S. 83° W., covering the breakwater or wooden pier; and *white* southward of the red sector when there is 10 feet depth of water or more at the pier head, and *green* when there is less than 10 feet at the pier head. The light should be seen in clear weather from a distance of 9 miles. The old light tower, 100 yards within this light, still remains.

Pilots.—There are nine licensed pilots belonging to St. Ives, four at Hayle, and one at Portreath, their limits extending from cape Cornwall to Trevoise head, including the ports between.

Tides.—It is high water, full and change, at St. Ives at 4h. 44m. local, or 5h. 6m. Greenwich time; springs rise 21 feet, and neaps 15 feet.

Directions.—There is no difficulty for a sailing vessel in entering St. Ives harbour with a leading wind, but it should not be attempted with a ground swell on, or with a gale from seaward. When Merran rock (a detached mass between Battery point and outer pier) is covered, there is a depth of 12 feet into the harbour. The Hoe rock, off Battery point, as well as Merran rock, when covered, will be cleared by keeping Knill's monument open to the eastward of the breakwater or outer pier; round the stone pier head closely, and run a warp to the buoys or pier as convenient.

Vessels entering the harbour at night should approach the pier with the light showing *white*, to avoid the breakwater and shoal off it, over which a *red* light is shown.

Small vessels lie aground at low water in St. Ives harbour, secure from all winds.

Coastguard.—Lifeboat.—A lifeboat, mortar, and rocket apparatus are maintained at St. Ives, which is also a coastguard station.

Supplies in moderate quantities can always be obtained at St. Ives; water is good and plentiful, and can be procured gratuitously by hose from several positions round the harbour.

Coal could be conveyed to steam-vessels in the bay by fishing boats. About 200 ton of coal (Welsh) are usually available.

Trade.—Boat building is carried on at St. Ives, as well as the repair of small vessels, some of its inhabitants find employment in the neighbouring mines, but its chief support is derived from the pilchard, herring, and mackerel fisheries ; the pilchards are generally exported in a cured state to the Italian market.

The principal imports are salt, timber, bricks, slate, and coals ; and the exports, fish. The population in 1881, date of last census, was 6,445. The Great Western Railway extends to St. Ives.

Coast.—From St. Ives to Hayle estuary the coast is composed of bold and cliff-bound slopes, varied by three sandy bays. Off Porthminster point (the southern point of the first bay), distant $1\frac{1}{4}$ cables, are the Carracks, 25 feet high.

HAYLE.—Hayle estuary is the outlet of several small streams, the south-easternmost of which, the Hayle, rises near Crowan, at St. Erth ; the eastern, or Copper-house stream falls into the channel about a mile from the mouth of the estuary and is crossed by an iron swing bridge. In the lower part of the estuary are reservoirs for sluicing ; there is also about one mile in length of wharfage available for trade, with depths of 17 to 20 feet alongside at high-water springs, but dry at low-water springs.

The bar has a depth of 20 feet at high-water springs, and 14 feet at high-water neaps. On the west side of the entrance channel, a half-tide dyke extends 643 yards from Chapel Anjou point, having five perches, or warping posts, erected on it ; two black buoys, on the same side, mark the continuation of the sand bank, known as Porth Kidney sands.

Tidal lights.—Upon the rising ground on the western side of the entrance, about 200 yards within Chapel Anjou point, are two wooden lighthouses, each exhibiting a *fixed white* light when there is a depth of 12 feet over the bar. The high lighthouse, painted red, stands on a tripod ; the low lighthouse, near the edge of the cliff, is placed on four legs, and painted black. The lights are 92 yards apart, elevated 81 and 59 feet respectively above high water, and in clear weather should be seen from a distance of 6 miles.

Pilots.—There are licensed pilots for Hayle, as stated on p. 36.

Directions.—At night, the lights in line lead in the best water over the bar ; they are only exhibited when there is 12 feet water or more. In case of any change in the direction of the channel, the lights admit of being shifted in order to preserve their character as leading marks. There is no day signal.

Supplies.—Trade.—Supplies of provisions, water, and marine stores are readily obtainable at Hayle. Coal may be put on board alongside the wharves, where vessels lie aground. There are slips for building and repairing vessels of considerable size, cranes capable of lifting 35 tons, and a factory for producing land and marine steam engines and mining machinery.

The foreign and coasting trade at Hayle is considerable, and the harbour affords excellent shelter for vessels. Between 800 and 900 vessels, of an aggregate tonnage of 100,000 tons, enter the port annually. A steam-tug is stationed at the port to assist vessels in and out of harbour.

Population in 1881 was 1,575. The Great Western Railway passes through Hayle.

Lifeboat.—A lifeboat and rocket apparatus are stationed near the custom house, on the eastern side of the harbour.

COAST.—From Hayle estuary to the mouth of the river Gwythian, distant about 3 miles, and just within Godrevy head, the eastern shore of St. Ives bay consists of a range of towans or sand-hills 100 to 150 feet in height, covered with grass; the beach in front, composed of fine sand and shells, has a breadth of 400 yards. Thence to Godrevy head the shore is backed by steep slopes, with rugged masses of rock projecting to low water mark.

Coastguard.—A detachment of coastguard is stationed at Gwythian.

Bessack rock lies about one mile S.W. by S. of Godrevy island, and 4 cables from the shore; it dries at two-thirds ebb.

Lelant church (a square tower over the west point of entrance to Hayle), just open of Black cliff, S.W., leads north-westward of the Bessack in 6 fathoms water.

GODREVY HEAD, the eastern boundary of St. Ives bay, is bold, 228 feet high, with rocky ledges extending $1\frac{1}{2}$ cables from its base.

Godrevy island, 80 feet high, is directly off the head, with a detached islet off its north-west side; its south-eastern side is studded with detached rocks, which dry at half-ebb. The Shore Lanner, a rocky ledge awash at low water, extends half a cable from its south-west side.

A passage nearly one cable in width, having a depth of one fathom, separates the island and its dangers from the foul ground off the head.

LIGHTS.—From the octagonal stone lighthouse, 86 feet high, north-west side of Godrevy island, is exhibited, at an elevation of

120 feet above high water, a *flashing white* light, showing a *flash every ten seconds*, and visible in clear weather from a distance of 15 miles.

To indicate the position of the Stones, a *fixed red* light is shown from the same tower, 27 feet below the *flashing* light. The *red* light is only visible when bearing from S. by E. $\frac{1}{4}$ E. to S.E. $\frac{1}{4}$ E., or in the direction of and covering those rocks.

During foggy weather a bell is sounded, one stroke *every five seconds*.

The STONES.—At the distance of $1\frac{1}{10}$ miles from Godrevy island lighthouse, in a N.W. $\frac{1}{2}$ N. direction, is Hevah rock, the most off-lying of the dangerous cluster known as the Stones. This rock uncovers at low water springs, and the 3-fathom boundary of the rocky bank surrounding it is more than $1\frac{1}{2}$ cables in extent. The greater portion of the danger lies within or eastward of Hevah rock, and is nearly half a mile in extent, with a deep water passage between it and Hevah rock, which should only be attempted in case of emergency; a strong tide sets across the passage. The rocks, which show at low water on the eastern part, are four in number, and they uncover from one-third to three-quarters ebb.

Buoy.—The Stones are marked by a black buoy, with staff and ball, placed in 10 fathoms at about a quarter of a mile north-eastward of the Hevah, with Godrevy island lighthouse bearing S.S.E. $\frac{1}{2}$ E., distant $1\frac{2}{10}$ miles, and Knill's monument midway between the farm and Fishery-beacon house at Porthminster; but as it is frequently washed away, no reliance should be placed on its being in position.

Clearing marks.—Gurnard head, just open of Carn Naun point, W. by S., leads one-third of a mile northward of the Stones. Gwinear church, in line with the eastern side of Godrevy island, S. $\frac{1}{4}$ W., leads eastward of the Stones; and Gwinear church in line with the old Engine chimney S. by E. $\frac{1}{4}$ E., leads nearly half a mile to the westward of them.

When passing the Stones at night, do not shoal to less than 12 fathoms at low water; nor bring the light at St. Ives to bear to the westward of S.W. by W.

The Sound, between the Stones and Godrevy island, is nearly half a mile wide, with a least known depth of $4\frac{1}{2}$ fathoms. The summit of Trecrobben hill, seen between Carrack Gladdon farm house and the Fishery-beacon house, bearing S.W. $\frac{3}{4}$ W., leads through.

Coast.—From Godrevy head to Portreath the cliffs average 250 feet in height, with a number of islets at about a cable distant from the shore. Off Navax point the Lethegga rocks extend one cable; thence 2 miles distant are the Samphire islands, 91 and 148 feet above high water; a third of a mile to the north-eastward are the Crane islands, 126 and 121 feet high, and two-thirds of a mile beyond in the same direction are the Horse and Basset, near Portreath, respectively 86 and 100 feet high.

Carnbrae monument, between Camborne and Redruth, is a prominent object from abreast here, its top being elevated 873 feet above high water.

PORTREATH, situated 4 miles eastward of Godrevy head, is a tidal harbour resorted to by coasters discharging coals and loading copper ore from adjacent mines, with which the place is connected by a mineral railway, a branch of the Great Western main line, 3 miles distant. 202 vessels of this class, of an aggregate tonnage of 26,000 tons, entered this port in 1888. Population in 1881 (last census) was 785.

The eastern side of the entrance is marked by a white tower, known as the Daymark, 25 feet high, and 123 feet above high water. Along the western side a pier projects in a northerly direction.

Within the harbour are two tidal basins, 300 feet by 100 feet, and 200 feet by 100 feet, with entrances 26 feet wide, protected by a boom. There is a depth on the sills of $15\frac{1}{2}$ feet at high water springs, and $9\frac{1}{2}$ feet at high water neaps. The tide rises 18 feet at the entrance of the outer harbour at springs, and 12 feet at neaps.

Directions.—Tidal signals are exhibited from the eastern hill, or from the long pier, by day; a red flag when a vessel may run in, a white one when to keep off. At night a *fixed red* light when to approach and wait for the pilot, a *fixed green* one when to keep off.

Portreath harbour should not be run for with a ground swell on, or during an on-shore gale, and care must be taken not to mistake Goodern, a rocky bight a little to the eastward, for the harbour. Should a sailing vessel become embayed between Godrevy island and St. Agnes head, and compelled to run on shore, the best place for beaching is under Amy point, on the western shore of the harbour, at or near high water, where, in most cases, the crew would be saved.

Coastguard.—A rocket apparatus is kept at the coastguard station at Portreath.

ST. AGNES' HEAD is a bold promontory backed by St. Agnes hill, with a beacon on its summit, elevated 617 feet above high water ; it has several mine buildings and chimneys on its north-east slope. Between the head and Portreath the coast is composed of cliffs from 150 to 200 feet in height.

Boden rocks are two detached rocks or islets lying N.N.E. $\frac{3}{4}$ E. distant one mile from St. Agnes' head, with a clear channel of about 7 fathoms water between.

Trevaunance, the small port of St. Agnes, lies in the depth of the bay about $1\frac{1}{2}$ miles eastward of the head ; it has a small harbour formed by a pier 200 feet in length, with a depth of 18 feet at the pier head at high water springs, and 12 feet at high water neaps. The breadth of the harbour is 90 feet ; entrance, 24 feet. The harbour is available for craft of 100 to 150 tons, and can only be entered in fine weather.

Tidal signals.—A red flag is shown from the pier by day, and a *white* light at night, when vessels of this description may enter. When there is little or no water, a white flag is shown by day and *two white* lights at night.

Copper ore and clay is exported in small quantities. Population, last census, St. Agnes parish, 5,000.

Coastguard.—Trevaunance is a coastguard station, where a rocket apparatus is kept. There is a detachment of coastguard at Porth Towan, about 2 miles southward of St. Agnes' head.

Ligger or Perran bay.—High cliffs continue from St. Agnes' head to the eastward, $3\frac{1}{2}$ miles to Porth Perran, beyond which for several miles there is much sand, both at the heads of the bay, known as Ligger or Perran bay, and upon the back slopes.

Holywell head, or Penhale point, about 5 miles north-east from St. Agnes' head, is well marked by some prominent mine buildings near its summit, and the Carters rock abreast it appears like a double pyramid when seen from the westward. Off Kelsey head, the north point of Holywell bay, are two small islets, named the Chicks, off which is a sunken danger with 16 feet water. Thence the coast, deeply indented, trends to Towan head, a distance of 2 miles.

Between Holywell bay and Towan head is Gunnel creek, available for small coasters at spring tides only ; its outlet lies between west and east Pentire points, the channel being close under the latter.

NEW QUAY.—* Towan or New Quay bay lies immediately eastward of Towan head (100 feet high), and in its south-western

* See Admiralty plan of Towan or New Quay bay, No. 1,168 ; scale, $m=12$ inches.

part is situated New Quay, whose sandy strand and buildings near the shore do not appear from the offing westward, until Towan head is rounded. There is a coastguard flagstaff on a hill with beacon, half a mile within Towan head. The little town of New Quay is a rising watering place.

The Tidal Harbour is formed by two piers, embracing an area of about 3 acres, and is available at high water springs for vessels of about 15 feet draught. The southern pier, 140 yards in length, and jetty adjoining are fitted with railway lines, in connection with G. W. Railway; vessels load or discharge into the trucks direct. The northern pier is about 70 yards in length; neither are fitted with cranes.

The entrance between the piers is eighty feet wide, with a depth of 17 feet at high water springs, and 12 feet at high water neaps; but the depth occasionally varies, for with a continuance of north-easterly gales, the sand is carried away to the depth of two feet, and in moderate weather it again accumulates.

During northerly gales a heavy sea sets in, which causes the vessels lying on the south-eastern side of the harbour to strike hard on the sandy bottom. The harbour should not be run for with a ground swell on, nor during a gale blowing on the land, for off the entrance, and for some distance outside, the sea breaks heavily.

Supplies.—The ordinary supplies of provisions are obtainable, and water in abundance is obtained from a well in the cliff. Ordinary repairs to sailing coasting craft undertaken.

During the year 1888, 117 vessels of the aggregate tonnage of 6,756 tons entered the harbour. Population, 1881 (last census), 1,600.

Exports are China clay and grain, value about £6,000; imports—coal, value £7,000.

Coastguard.—Lifeboat.—A lifeboat is maintained here; there is also a coastguard station (the head-quarters of the division of the district), and a rocket apparatus at New Quay.

The Coast from New Quay trends north-eastward 8 miles, to Trevoze head; it is high, precipitous, and deeply indented. About midway lies Park head, with foul ground extending to the distance of 3 cables.

The indentation in the coast, about 2 miles north-eastward of New Quay, is known as Watergate bay, and is fronted by a sandy beach to the distance of $1\frac{1}{2}$ cables.*

* See Admiralty chart, No. 2,565.

St. Colomb Porth, an inlet situated near Trevelgue head, one mile eastward of New Quay, though dry at low water, and open to the westward, is the resort of small coasters with cargoes of coal.

Mawgan Porth, about $2\frac{1}{2}$ miles northward of St. Colomb, and well marked by its sandy strand, is also shallow at its entrance, and exposed ; here is a coastguard station and rocket apparatus. The tall square tower of St. Eval church, situated 2 miles within Park head, is a conspicuous object.

TREVOSE HEAD, 232 feet in height, is one of the best land-falls to make when bound from the westward towards the Bristol Channel. When first seen, the land within it being considerably lower, it has the appearance of a round island ; on nearing the land, the white lighthouse on its north-western part, the coastguard cottages on the neck within, together with the Quies rocks lying one mile westward of the head, serve well to distinguish it ; the cottages are not visible when abreast the head.

Coastguard.—There is a detachment of coastguard here, and rocket apparatus is kept at Trevoze farm in case of shipwreck.

LIGHT.—From a lighthouse 87 feet high, painted white, erected on the north-west part of Trevoze head, is exhibited at an elevation of 204 feet above high water, an *occulting white* light, which is visible in clear weather from a distance of 20 miles.

The light is under *occultation three times* in quick succession *every minute* ; each period of darkness and of light occupying *three seconds*.

Quies rocks, about a quarter of a mile in extent, lie 9 cables W.N.W. from Dinas point, the western horn of Trevoze head. The group consists of four principal rocks, the south-eastern mass being the highest ; the others are black and rugged. The deep water passage, half a mile wide, between the Quies and the Moor Quie, another mass of rock close to Dinas point, should never be used except in cases of necessity.

Gulland islet, 93 feet high, is a bold rock lying midway between Trevoze head and Padstow bay, and distant $1\frac{1}{4}$ miles from the shore. Gurley and Chimney rocks, situated three-quarters of a mile and one mile respectively within the Gulland, each have a depth of 11 feet at low water. Merope, Pollards and Perleze rocks, lie from 2 to 3 cables from the shore eastward of Trevoze head.

PADSTOW BAY is included between Stepper point and Pentire head, one mile apart ; the direct approach is free from

danger, with easy tides ; there is a depth of 7 to 8 fathoms in the bay, but the ground swell common to the coast renders it, however, unfit for anchorage.*

Dangers.—About half a mile north-westward of Pentire head is the Newland, a bold pyramidal islet 114 feet high, having several out-lying rocks, viz., the Rainer rocks, which dry at half-tide, and extend one cable to the westward ; the King Philip and Villiers rocks, to the eastward ; the latter with 6 feet over it, at one cable distance. The Roscarrack, another sunken danger with 9 feet water, lies N.W. $\frac{1}{2}$ W. one-quarter of a mile from Rumps point. About $1\frac{1}{2}$ miles southward of Pentire head is Trebetherick point, Hayle bay intervening, and between this and Stepper point, a distance of half a mile, is the entrance to Padstow harbour, formed by the estuary of the river Camel.

The Camel, or crooked river, takes its rise at the foot of Rough Tor on the north-east side of Cornwall, and has an estuary 6 miles in length, with an average width of nearly half a mile ; but from Wadebridge to Padstow, which latter is on the western shore $1\frac{1}{2}$ miles from the entrance, it is dry at low water, with the exception of a narrow winding channel with a depth of one to 2 feet water.

PADSTOW HARBOUR.—**Day-mark.**—**Look-out.**—Stepper point, the north-west boundary of the entrance to Padstow harbour, is moderately high, bold-to, free from danger ; it is easily distinguished by a conspicuous white tower, or day-mark, 40 feet in height, and 272 feet above high water, on the north-west side of the point, and may be seen from the distance of about 20 miles in clear weather. There is also a look-out house for the pilots upon the slightly higher ground within it, and upon the brow just within the extremity of the point is a staff, having affixed to it a caution board, warning strangers to round the point closely in entering. About half-way up Stepper point hill is placed a signal post ; here also is a rocket station.

Bar.—The navigable channel is closely confined to the bold shore within Stepper point by an extensive tract of sand named Doom bar, which stretches out from Trebetherick point and Brae hill on the eastern shore, and occupies four-fifths of the mouth of the harbour or estuary ; it is the north-western extremity of this sand or the “Ketch,” which is only one cable distant from the

* See Admiralty plans :—Padstow bay, with views, No. 1,686, scale, $m = 4\cdot0$ inches ; Padstow harbour, No. 1,683, scale, $m = 16\cdot2$ inches ; and coast charts, Nos. 2,565 and 1,173.

western shore, that constitutes the special danger in entering Padstow harbour. At Stepper point, the mouth of the channel is crossed by a bar of sand and shingle with 16 feet at low water springs and 36 feet at high water springs ; thence the depth is about 4 fathoms at low water, bottom of blue clay, as far as Hawkers cove, half a mile within, where there is secure anchorage. About a quarter of a mile above Hawkers cove the channel, between Razor and Middle banks, has but 4 feet water for the distance of half a cable, within which it deepens a few feet ; abreast Horse Shoe bank is a pool half a mile in length, with an average low water depth of 2 fathoms ; thence the depth is about one fathom to abreast the tidal harbour $1\frac{1}{2}$ miles above the bar.

Pilots.—There are licensed pilots for Padstow, who are always on the look-out at tide-time by day and night ; the pilots' house is over Stepper point. They cannot board vessels outside Stepper point in heavy weather, but they may be obtained immediately the vessel has rounded the point. The usual pilot signal is observed.

Tides.—It is high water, full and change, at Padstow at 5h. 13m., or 5h. 33m. Greenwich time. Springs rise $20\frac{1}{2}$ feet, and neaps $16\frac{1}{4}$ feet. The flood stream into the entrance is easy, but the ebb is strong after the first-quarter, when the set is no longer over the Doom bar, but is confined between the edge of the bar and the western shore.

Directions.—The best time for entering Padstow harbour is from half-flood to high-water, but steam vessels of about 12 feet draught may enter at any time as far as Hawkers cove, half a mile above the bar ; it should not be attempted in a sailing vessel after half-ebb, except in a case of necessity.

The best winds for entering the harbour are those between N. by W. (by the north) to E.S.E. as they will be found steady. When approaching the harbour, pass between Gulland and Newland islets, which is free from danger. Round Stepper point close-to, and keep close along the straight shore of steep cliffs, with Newland shut in so as to avoid the Doom bar, and if a pilot is not at hand, proceed as far as Hawkers cove, and anchor close in abreast it, in 15 to 20 feet at low water. Should the vessel have lost her anchors, lay her upon the soft ground of Harbour cove, where she will be secure in nearly all winds.

To proceed up the river to Padstow, the assistance of a pilot is necessary, for both the height and shape of the sands occasionally change.

Caution.—The ebb stream during springs runs strongly out of Padstow harbour, and several wrecks have occurred from sailing vessels attempting to enter on a falling tide, and with the wind scant.

Another point requiring careful attention is, that with winds from the westward of north-west, when the port is more generally required for shelter, baffling winds will be found to set off the high land within Stepper point, and if unprepared, drive a vessel to leeward on to the Doom bar. Standing in therefore under such circumstances, have an anchor and warp ready, and with a press of sail round the point as close as possible and either shoot into the leading wind, or as far as possible towards the rocks, and let go the anchor, when the ship will be in comparatively smooth water, and assistance from the shore will be promptly rendered. There are several capstans and warping bollards along the shore.

Coastguard.—Lifeboat.—Padstow is a coastguard station. A lifeboat is kept at the head of Hawkers cove half a mile within the entrance, and a rocket apparatus at Stepper, and near to Trebetherick points ; at the latter there is also a coastguard detachment.

Tidal Harbour and Light.—The small harbour of Padstow, dry about 6 feet at low water springs, adjoining the town, affords a depth of 16 feet at high water springs, and 10 feet at neaps. During the winter months, a *red* light is shown from the south pier, and a *green* one from the north pier ; these can only be seen after rounding St. Saviour's point, and are generally extinguished after midnight.

Trade.—Supplies of the ordinary description may be obtained at Padstow, and water from the various wells without charge.

Padstow is a place of call to steam-vessels trading between London, Penzance, Swansea, and Bristol. The chief imports are coals, timber, and manure ; and the exports, copper and other ores, and grain.

At Wadebridge there is a foundry, which absorbs more than half the trade of the port. Rock village, with its small quay, is on the opposite side of the estuary from Padstow, and divides with it the remainder.

The number of vessels belonging to the port is about 120 ; tonnage, 9,700. About 700 vessels enter annually, of the aggregate tonnage of about 40,000. The population in 1881 (date of last census) numbered 2,191.

COAST.—Between Pentire head at the entrance to Padstow, and Hartland point, a distance of 30 miles, there are no dangers beyond a quarter of a mile from the shore ; yet as the coast is rocky

and steep throughout, with the prevailing ground swell and an inset of tide towards Widemouth bay, sailing vessels bound up or down the Bristol channel should avoid a too close approach to it.

Between Pentire head and Rumps point the cliffs are bold and dark, and the grassy banks above, interspersed here and there among the rocks, give to the northern slopes, when seen from the westward, the appearance of a cock's comb. About $1\frac{1}{2}$ cables eastward of Rumps point is Moulds island, pyramidal in shape, and 154 feet high.

PORT QUIN BAY.—The indentation $1\frac{1}{4}$ miles wide, between Moulds island and Kellan head is bounded by steep and nearly inaccessible rocky cliffs, having a few inlets, or breaks, but no variety of feature sufficiently prominent to distinguish one part from another, except at port Quin. The holding ground is good, and small coasters occasionally seek shelter on the western side from winds between north and west.

Port Quin.—The small inlet of port Quin is at the eastern side of the bay, between Doidon point, a triangular shaped cliff with a short tower or summer house just within it, and Kellan head, a rounded hill with dark cliffs. Endellyon church, with its square tower elevated 462 feet, shows distinctly upon the outline above it, and a well marked road leads up the slope in a south-easterly direction.

The port is only available for small coasters at high water. The Cow rocks, dry at half-ebb, lie N.N.E. one cable from Doidon point.

PORT ISAAC, $1\frac{1}{2}$ miles eastward of port Quin, is available for small coasting craft at high water ; its approach is bounded to the westward by Varley point, which slopes irregularly to the north-westward, and on the east side by a point, having on it a coastguard station and flag-staff ; the tower of Endellyon church, bearing S. by W., leads to it from the offing. Boats can generally put out in moderate weather, and it is by far the best place between Padstow and Hartland point for beaching a vessel caught in the bight between the two, and unable to weather Tintagell head, whereby many vessels have been saved. In such a case, if it be practicable, hang off until the ebb is making ; avoid a rock on the eastern side on which the sea will be breaking, and then keep in the middle of the cove, and beach at its head, which has a fair sandy bottom ; the vessel consequently would be damaged or lost, but the crew saved.*

Pilots.—At port Isaac are a number of enterprising fishermen, ready to act as pilots for Padstow and the neighbouring creeks.

* See Admiralty chart, Trevoze head to Bull point, No. 1178.

Coastguard.—Lifeboat.—Port Isaac is a coastguard station ; a lifeboat and rocket apparatus are kept here.

PORT GAVORNE, a creek half a mile eastward of port Isaac, is frequented by coasters to load slates from the neighbouring quarries, and is available only at high water. The houses at the head of the creek show prominently when the port opens, and a conspicuous road leads over the south-eastern brow.

Tintagell head, 250 feet high, is a bluff and prominent headland, forming the south-western horn of Widemouth bay ; from abreast it may be known by Tintagell church, with a short square tower, which stands just within the cliffs not far southward of it, and by the head being backed by several rounded ridges, which are higher than any portion of the neighbouring coast. Otterham rock, 130 feet high, and half a mile from the shore, is $1\frac{1}{2}$ miles south-westward of the head. Castle cove, on the east side of the head, is used for loading slate in fine weather.

BOSCASTLE, or **Botreaux**, is a creek 3 miles eastward of Tintagell head ; at its head is a small pier that affords shelter to the coasters that frequent it, but it is only available at high water. It will be recognized by Meachard rock, 120 feet high, about 2 cables off it, by the low tower and white house on Willow park point, west side of entrance, and the coastguard look-out on the east side. There are no sunken rocks off the creek, and it may be approached with confidence, except when there is a ground swell setting on the coast ; it is then inaccessible. Coasting craft may anchor within Meachard rock in fine weather, and communicate by boat with the creek.

Coastguard.—Rocket station.—A detachment of coastguard is stationed at Boscastle ; here also is a rocket life-saving apparatus.

The coast from Boscastle to Widemouth bay and Bude, is bold and indented, with cliffs varying in height from 120 to 700 feet. From Bude to Hartland the character of the coast is much the same, without any special feature to distinguish at a moderate distance one part from another.

BUDE HAVEN is principally resorted to by coasting craft of from 30 to 50 tons. Chapel rock, dry at low water, is connected to the shore by a small breakwater, forming a defence to the entrance of a canal which affords communication with Launceston, &c., and is principally used for the conveyance of shells and sea-sand for manure.

The canal lock forms the port, and vessels drawing 10 feet can enter it at spring tides and lie secure; departure from it, however, in sailing craft, is attended with difficulty when there is any swell upon the coast.

Tidal signals.—When vessels are waiting off the port to enter, a red ensign by day, and a white light by night, is shown from Chapel rock, one hour before and after high water.

Landmarks.—On the western side of the haven the land is from 100 to 120 feet in height, and is marked by a flagstaff; the eastern side is low and flat for half a mile. On the summit of the coast cliff half a mile southward of Bude, is Efford beacon, 193 feet high.

Coastguard.—Lifeboat.—Bude is a coastguard station; a lifeboat and rocket apparatus are stationed here.

Tides.—It is high water, full and change, at Bude haven at 5h. 45m.; springs rise 23 feet, and neaps 17 feet.

HARTLAND QUAY, is situated nearly 2 miles southward of Hartland point. It consists of a single arm extending in a north-east direction, capable of sheltering a couple of craft of 50 tons, and a few fishing boats. There is a depth of 18 feet water at high water springs, and 11 feet at neaps, over a hard bottom.

Keep half a mile or more off shore when approaching Hartland quay, in order to avoid some straggling sunken rocks, which lie on each side of the bight; the quay may be steered for when bearing S.S.E. $\frac{1}{2}$ E. There is, at times, a very heavy sea at the back of this little quay, and southerly winds occasion a violent run within it; it is consequently seldom frequented, but as it is the nearest landing place to Hartland, and the best refuge between Bude and Clovelly, coasters should be aware of its situation and character.

The flood stream only is felt close off the quay.

A detachment of coastguard is stationed at Hartland quay.

HARTLAND POINT, the western horn of Barnstaple bay and the nearest land to Lundy island (distant $9\frac{1}{2}$ miles), is rendered prominent by the cliffs trending at a right angle from each other. The point is the termination of a dark brown table-land, elevated 350 feet above the sea, towards which it has a steep slope, the adjoining cliffs being perpendicular; the circular white lighthouse on the point is the distinguishing feature. Near the extremity of the head is a gap, which partly separates it, and materially assists in marking it.*

LIGHT.—From a circular white lighthouse 59 feet high, erected below the summit of Hartland point, is exhibited at an elevation of

* See View A, on Admiralty chart, No. 1,178.

120 feet above high water, a *revolving* light, showing alternately, at *half-minute* intervals, *white and red* flashes, in the order of *two* white flashes to *one* red ; and visible in clear weather from a distance of 17 miles.

Fog signal.—A powerful fog-horn, in thick or foggy weather, will give *two blasts* in quick succession *every two minutes*:—the first blast a high note, the second a low note.

Tings rocks dry out at low water springs from Hartland point a quarter of a mile in a northerly direction, with from 6 to 9 fathoms close-to. Sharpnose point bearing S.S.W. $\frac{1}{2}$ W., leads westward of them, and as long as Gallantry bower near Clovelly, is visible, bearing S.E. $\frac{1}{2}$ E., a vessel will be northward of them ; the first of the ebb tide sets westward over the rocks.

Tides.—Midway between Hartland point and Lundy island the tidal streams set nearly east and west, turning with high and low water by the shore ; the rate is 3 knots at springs and 2 knots at neap tides. A race extends a distance of 2 miles off Hartland point.

CHAPTER III.

BRISTOL CHANNEL.—SOUTH SHORE.—BARNSTAPLE BAY
TO BRIDGEWATER.

VARIATION IN 1891.

Lundy island - 19° 30' W. | Minehead - - 18° 50' W.

General Remarks.—The entrance to the Bristol channel is between Hartland point in Devonshire, and St. Ann's head in Pembrokeshire, a distance of 47 miles. This line passes through Lundy island, which, being marked by a lofty lighthouse, and a first-class light, serves as an invaluable beacon to all vessels bound up the Bristol channel from seaward. The passage on either side of the island is equally good, and it is so placed that sailing vessels having to make it in south-westerly winds are not obliged to borrow upon or to close either shore.* *See directions for approaching, pages 3, 4.*

LUNDY ISLAND,† which rises to an elevation of 443 feet above high water, is $2\frac{1}{2}$ miles in length in a nearly north and south direction, by two-thirds of a mile in breadth, and consists for the most part of granite. The island is encircled by nearly inaccessible cliffs, except at the south-east end, where landing may be effected in fair weather on a little beach eastward of the castle, from whence a road has been constructed to the summit. The surface of the island contains about 2,000 acres, and the house of the proprietor is in the valley to the right of the ascent, surrounded by a few pines and sycamores, the only trees on the island. There is also a farm-house and outbuildings visible from the anchorage in Lundy road, while the keep of Marisco castle, a stronghold about the time of Henry III., stands conspicuously on the summit of the south-east end of the island. The few inhabitants are employed in working the stone quarries, and in cultivating a portion of the island. Oats, barley and potatoes are grown and there is a considerable number of cattle and sheep. The staple produce is the rabbits and the feathers of the sea-fowl. Lundy is

* *See Admiralty chart :—Bristol Channel, No. 1,179 ; scale, $m = 0\cdot5$ inch.*

† *See Admiralty chart, Lundy island, No. 36, scale, $m = 3\cdot25$ inches ; also Trevose head to Bull point, No. 1,178.*

bleak and inclement; there are frequent instances of cattle being blown over the cliffs. Population in 1881 was 177.

Refuge.—Lundy island affords sheltered anchorage with good holding ground, free from the strength of the tide, for all classes of vessels; and is from its position, as a natural breakwater, stretching partly across the entrance to the Bristol channel, a most eligible stopping place for all vessels struggling to the westward, as well as a port of refuge for them if driven back, none of much value offering nearer than Cardiff or Penarth roads, a distance of 60 miles to leeward. Under the lee of Lundy island a vessel would hold her own, and thus avoid additional risk and detention, and be able to put to sea without further pilotage when the wind changed or moderated. Upwards of 100 vessels have been at anchor here at one time. See Anchorage, page 55.

Lloyd's signal station.—There is a Lloyd's signal station near Marisco castle, south end of Lundy island, through which vessels hoisting their code signal letters can be reported. Lundy is connected with Hartland point by sub-marine cable*, thence by land lines.

Pilots.—Pilots for any port of the Bristol channel are nearly always to be found at the Lundy island anchorages. With the wind less than a gale from the northward the tugs and pilot boats anchor in the Rattles, south end of Lundy, or just to the northward of Shutter point (depending on the wind), where they are fairly well sheltered.

In very bad weather, with the wind either from the North or South, when their boats cannot lie at Lundy island anchorages, they will be found off Ilfracombe, about 20 miles farther up.

Supplies.—Water, live-stock, and vegetables, in small quantities, can be obtained from the farms.

LIGHTS.—Lundy lighthouse, which stands half a mile from the southern end of the island, and 100 yards from the brow of the western cliff, is a granite circular tower, painted white, and 96 feet in height.

Two *white* lights are shown from it; the upper shows *one flash every minute*, at a height of 540 feet above high water, and is visible in clear weather at a distance of 30 miles.

The lower light is *fixed*, at 470 feet above high water, and is visible from the westward between the bearings of S. by E. and N.E. Being

* Not in working order 1890, but will probably be repaired.

only 17 feet above the general level of the cliffs, the low light is concealed from the deck of an ordinary vessel approaching too near the shore, so that when hovering under the west side of the island to avoid the ebb stream, she will be free of all outlying dangers as long as the lower light is kept in sight.

Fog signal.—On the west side of the island, distant 4 cables from the lighthouse, is a rocket station, from which during thick and foggy weather a rocket, which explodes with a loud report on reaching the height of about 600 feet, is discharged at intervals of *ten minutes*.

Islets and rocks.—Hen and Chickens rocks dry from 5 to 10 feet at low-water springs, and extend about 3 cables in a north-west direction from the north point of Lundy; the outer patch dries 5 feet at low water, and as there is a depth of 16 to 18 fathoms close to, they should be given a wide berth. Black rock, off the south-west point of the island, kept in sight, leads westward of them.

On the north-east side of Lundy, are some detached islets or rocks; the Gannet stone, the largest and highest, is about 80 feet high, the Seal and Gull are 6 feet high, and of small extent; they all lie within half a cable of the foot of the cliffs. Knoll pins, extending nearly a cable from Tibbet point, cover at half-tide.

Rat island, a green hummock, under and to the eastward of Castle bluff, is an island only at high water; a rocky ledge, dry at low-water springs, extends one cable south-eastward from it; also a rock with 15 feet water lies S.S.E., distant 2 cables.

Lee rocks, 2 heads, with 9 feet at low water, lie one-quarter of a mile from the south-east point of Lundy island, with Marisco castle bearing North. Several vessels have struck upon this danger while rounding-to under the lee of the island to discharge their pilots.

On the west side also there are several rocks; Black rock, 15 feet high, is a conical mass lying one cable off the south-west point; outside it, distant nearly two-thirds of a cable, is a rock which dries 6 feet at low-water. Half-tide rock, under the lighthouse, dries 7 feet; Needle rock, with several heads extending from it, which also dry about 7 feet, lies south-westward of Jenny cove; and some others, none however more than $1\frac{1}{2}$ cables from the island.

North-west bank.—There are several banks in the vicinity of Lundy island. North-west bank, with 7 fathoms least water, and extending within the 10-fathom line over a distance of 2 miles in an east-north-east and opposite direction, lies one mile to the westward

of the north end of the island, from which the bank is almost separated by a channel, with depths above 20 fathoms. The bank consists of fine brown sand, and being clear of the influence of the ebb stream, sailing vessels occasionally anchor on it in light or adverse winds, but this bank must naturally be avoided when blowing strong from the westward.

The White Horses.—Stanley bank.—A bank of sand, with depths of 20 fathoms and less, extends about 4 miles north-eastward of Lundy island. From 2 to 3 miles in this direction the depths are irregular, ranging from $4\frac{1}{2}$ to 10 fathoms, and named from the race over it, the White Horses.

The shoal patch of $4\frac{1}{2}$ fathoms (named Stanley bank, after the officer who found it in 1879), lies with the north-west point of Lundy island bearing W. $\frac{3}{4}$ S., distant rather more than $2\frac{3}{10}$ miles, and Lundy lighthouse S.W. $\frac{3}{4}$ W. westerly. Heavy tide rips point out the position of the bank during the strength of the streams.

East bank, composed of sand and fine broken shells, is of triangular shape, and lies about one-mile eastward of the southern half of Lundy island. Within the 10-fathom line it is one mile in length, and about three-quarters of a mile in breadth at its northern part; the least depth is $5\frac{1}{2}$ fathoms, with Rat island bearing W.S.W., distant 8 cables. Between East bank and Tibbet point is a smaller bank of 10 fathoms.

Tides.—It is high water, full and change, at Lundy at 5h. 15m. local, or 5h. 33m. Greenwich time; ordinary springs rise 27 feet, and neaps 20 feet. At 3 miles westward from the lighthouse the flood stream divides, and passes north and south of the island; the ebb stream splits in like manner 3 miles eastward of the island. The flood streams set northward along the west side of the island, while the ebb stream is scarcely perceptible within the 3 miles mentioned. On the east side of the island the ebb stream sets to the southward from half-flood until low water; the northerly set does not obtain a greater rate than one knot, and is not felt close in.

Races.—Within the range of one mile from the north and south extremities of Lundy island the tidal stream, during its strength, runs at the rate of 5 knots per hour; decreasing to 3 knots at springs and 2 knots at neaps at an offing of 3 or 4 miles. This concentrated set at the extremities of the island occasions several races, and a heavy sea when the tide is opposed by the wind—the race, at such times, off the Hen and Chickens presents an alarming appearance, though the depth is not less than 25 fathoms; the

water over the North-west bank is also at times considerably disturbed. Over the White Horses, where, on Stanley bank, there is as little as $4\frac{1}{2}$ fathoms, the race breaks so heavily at times, that vessels will adopt a prudent course, during heavy weather, by passing southward of the island, for though there are races off Black rock and Rat island, they are neither so weighty nor so extensive as those off the north end.

ANCHORAGES.—Lundy island road, situated between Tibbet point and Rat island, on the east side of Lundy island, affords anchorage space for a considerable number of vessels in westerly winds; as many as a hundred have been observed at anchor at one time during a westerly gale, chiefly steam vessels engaged in the coal trade, many of large tonnage; with easterly winds the strain on the ground tackle is considerably relieved by the under-tow or back-set from the island, but vessels should leave it on the first signs of a wind from that direction.

The inner anchorage in from 7 to 10 fathoms, sand, from 3 to 4 cables off shore, is protected from winds between North, through west and South-west; a good position in 10 fathoms is with Gannet stone just open of Tibbet point, and east extreme of Rat island S.S.W. From this position, should the wind change to the eastward and a sailing vessel have to slip, she would be able to clear the island and run round under its lee. Small steam vessels may anchor nearer the landing place under Lloyd's signal station in 6 to 7 fathoms.

The outer anchorage, in from 11 to 13 fathoms, about half a mile off-shore, is more suitable for long and heavy draught vessels; it is protected from westerly winds between N. by W. and S.W. A good position is with the extremes of the island bearing N. $\frac{3}{4}$ W. and S.S.W. $\frac{1}{4}$ W., and the quarry pier West. Here there will be about 12 fathoms water within East bank, affording the advantage of dragging uphill in case of heavy weather. At night, the anchor should be let go with the light just dipping behind the land, and bearing about W. by S.

Rattles bay.—At the south end of the island, Rattles bay affords shelter for small steam vessels in from 6 to 10 fathoms, during north and north-easterly winds; a scrambling path leads up the steep slope of the bay to the summit. The anchorage is an exceedingly uncomfortable one, and is appropriately named; unless a vessel is very close inshore she lies on the edge of the race.

West side.—There is good shelter from easterly gales under the west side of Lundy island, especially to steam vessels that can anchor close in; here they may anchor in about 10 fathoms, but the water deepens quickly to 20 fathoms outside that depth; thence, however, it gradually shoals again towards North-west bank, where depths of 7 to 9 fathoms will be found. The best position under the island is in Jenny cove, in from 6 to 10 fathoms, avoiding the rocks which extend $1\frac{1}{2}$ cables off Needles rock; these will show towards low water.

Prohibited anchorage.—To avoid injury to the sub-marine cable laid between the south end of Lundy island and Hartland point, vessels are prohibited from anchoring either within 2 cables length of Rat island, south-east extreme of Lundy, or anywhere in the channel within one mile of an imaginary line drawn between Rat island and Shipload bay, situated one mile east of Hartland point. When one or other of these points is invisible, vessels should not anchor until they are westward of an imaginary line on which Lundy island light bears N. by W., or Hartland point light S. by W.; or until at least 2 miles eastward of the same bearings.*

COAST OF DEVON, CONTINUED FROM PAGE 50.

BARNSTAPLE BAY is included between Hartland and Morte points. The indraught into the bay should deter sailing vessels from passing within the line of the points, except in settled weather, or when bound to Clovelly or over Barnstaple bar, for a sudden gale from the N.W. (which generally succeeds one from south-west) would expose a vessel caught within the bay to the risk of being driven on shore, it being impossible to claw off on the flood, or to obtain the slightest shelter with the wind between W.N.W. and N.E. To those who use the lead the soundings will be sufficient to prevent becoming embayed in thick weather, as there is a depth of 20 fathoms over a good bottom outside the above line, and 15 fathoms over sand immediately within it. With southerly winds, anchorage for a tide may be taken up anywhere to the eastward of Clovelly, with good holding ground and moderate depths.†

CLOVELLY.—Clovelly fishing village is situated upon the face of a thickly-wooded brow, 5 miles within or south-eastward of Hartland point; the intermediate coast consists of nearly perpendicular cliffs, the most conspicuous among them being Gallantry bower,

* *Shipping Gazette*, 20th September, 1886.

† See Admiralty chart:—Trevose head to Bull point, No. 1,178; scale, $m = 0.5$ of an inch.

360 feet above high water, and crested by a remarkable clump of trees. For the entire distance there is a depth of 8 fathoms at a quarter of a mile off shore, with but little stream on the flood, and a moderate stream on the ebb.

Its position is well marked by Clovelly court, a large freestone mansion upon the summit of the brow, half a mile north-westward of the village, which, consisting of one street down the slope of the hill, is a fairly good mark by day. Population in 1881 was 787.

The pier is a rude, short structure curved to the eastward, and does not prevent a considerable in-run of the sea; the ground also is hard and uneven, except along-side. To the embayed coaster, however, Clovelly affords a refuge easy of access, and will contain about half a dozen vessels, but it has only a depth of 14 feet at high-water springs, and 8 feet at high-water neaps.

It is the resort of fishing boats, and of coasting craft importing limestone from Wales.

LIGHT.—A *fixed* light (for the fishermen) is exhibited at the extremity of the pier from 1st September to 1st February; it shows *red* from 4 hours flood to 2 hours ebb, at which time there will be a depth of at least 5 feet in the harbour, and *white* during the remainder of the tide.

Anchorage.—Clovelly road affords good anchorage in comparatively smooth water, with the wind as far northerly as W.N.W., and even to N.W. The best anchorage is in 5 fathoms, mud, three-quarters of a mile off the pier, with the east end of the village over the pier-head W.S.W., and the western land a little open of Gallantry bower, N.W. $\frac{3}{4}$ W. Small craft may anchor 2 to 3 cables off the pier in 4 fathoms, avoiding Bucks ledge (p. 58), when coming from the eastward.

Lifeboat and Rocket station.—A lifeboat is stationed at Clovelly, and a rocket apparatus kept at the coastguard station.

A detachment of coastguard is stationed at Peppercombe, about halfway to Bideford.

Coast.—Ledges.—The land eastward from Clovelly continues high, and partially clothed with stunted wood for 6 miles to Rocks nose, with clusters of white houses upon the braes at Buckish and Peppercombe.

Rocks nose is the termination of the rocky shore, and has, on a summit half a mile within, an old summer-house named Cornborough; from thence, extending for 5 miles in a north-easterly direction, are the Northam and Branton burrows, a succession of

low sand-hills which terminate at Downend, and are fronted by extensive sands drying out at low water half a mile, and to more than double the distance at the outlet of the rivers Taw and Torridge.

Bucks ledge.—At $1\frac{1}{2}$ miles south-eastward of Clovelly is Bucks ledge, which dries nearly half a mile off Buckish mill at low-water springs, with a depth of 6 feet only at two-thirds of a mile off-shore. Chapman rock kept in sight, open of Clovelly bluff, leads northward of it.

Lakenose rock.—At $1\frac{1}{2}$ miles westward of Rocks nose point, where the high rocky coast falls towards the valley of Bideford, and half a mile from the coast, is Lakenose rock, awash at low-water springs.

RIVERS TAW AND TORRIDGE find their outlet through the broad sandy strand at the head of Barnstaple bay.

THE TAW, about 50 miles in length, rises near Crasmere in Dartmoor; it has a general northerly course, and becomes navigable for boats towards high water, and subject to tidal influence, about 3 miles above Barnstaple. It passes the southern face of this town, where it is crossed by a bridge of 16 arches, and is then joined by the river Yeo; taking a westerly direction it unites at Appledore with the river Torridge, and falls into the bay 7 miles below the town, and 2 miles from the confluence of the rivers. The estuary of the Taw at high water is of considerable extent below Barnstaple, but at low water, in the reach between Appledore and Fremington, the stream does not exceed 200 yards in width, nor has, with the exception of a few pools of from 2 to 4 fathoms, a greater depth than 7 feet; above this, between Fremington and Barnstaple, the channel is winding, irregular, and nearly dry.

The navigation from the sea to Barnstaple is difficult at all times, owing to the strength of the tides, its winding channel, and the constant alteration in the sandbanks; the difficulty is also increased by the fishing-weirs which are placed across the stream, causing numerous accidents and complaints, but may be considered navigable at high-water springs for vessels drawing 8 to 10 feet, but at high-water neap tides, boats only can reach the quays. The duration of the flood at the town is $1\frac{3}{4}$ hours, the ebb making very quickly. At Fremington, $2\frac{1}{2}$ miles below, there is a quay in close proximity to the railway connecting Barnstaple and Bideford, which vessels of the above-mentioned draught can reach at any high water, and take the ground. The general stopping place for such as are

bound to Barnstaple is at Pages pill, 2 miles below the quay, where they lie on the flat, secured to mooring posts ; or on Braunton sands opposite, where they are completely sheltered in N.W. gales by a high tongue of shingle extending off the north point of the entrance.

THE TORRIDGE, about 60 miles in length, rises at the distance of a few yards only from the source of the Tamar. Its course is in a south-east direction to the vicinity of Hathersleigh, thence north and north-west past Torrington and Wear Gifford, where it becomes navigable for boats, towards high water, to Bideford, and is here crossed by an ancient bridge of 23 arches and 677 feet in length. Below the town the river expands into a considerable high-water estuary, and trends northward $2\frac{1}{2}$ miles to between the villages of Appledore and Instow, where it is one-third of a mile broad, and where, as before observed, it unites with the Taw and discharges into Barnstaple or Bideford bay.

Navigation.—The Torridge possesses advantages over the Taw, for it has fewer obstructions and a greater depth of water over a shorter distance to the port of Bideford, where vessels drawing 14 to 16 feet may reach the quay during springs.

There is, however, an evil common to both rivers, which may here be noted, viz., the promiscuous deposit of the limestone imported from Wales, which is dropped in the most reckless way along the foreshores of the rivers, and projects into the navigable channels ; these heaps covering at half-tide, and being generally unmarked by beacons, have, like the fishing weirs, been the cause of many accidents.*

BARNSTAPLE or BIDEFORD BAR, composed of sand and gravel, with a least depth of about 4 feet over it at low-water springs, and 27 feet at high-water springs, lies about $1\frac{1}{2}$ miles outside the points of the estuary ; it is one mile in length within the depth of 3 fathoms, with an average breadth of $1\frac{1}{2}$ cables between the North and South sands which border it. Within this bar the water deepens from 3 to 6 fathoms in a narrow pool about half a mile in length, whence it again shallows to about 4 feet for the distance of one mile, to Appledore pool (p. 61), where there is anchorage in from $2\frac{1}{2}$ to 5 fathoms. Vessels proceeding beyond Appledore pool have to lie aground. Abreast the inner end of the bar, and on its south side, a gravel patch dries 7 feet above low-water springs, while on the north side a similar patch dries 19 feet. From the northern shore, abreast the lighthouses, project the Old Wall rocks and the Crow and Sprat

* Statement verified, 1889.

ridges, the latter forcing the channel over to the western shore near Appledore.

Outer anchorage.—Vessels waiting for sufficient water to cross the bar may anchor in 7 to 8 fathoms, about half a mile outside the fairway bell buoy, with Cornborough summer house bearing S. $\frac{3}{4}$ W.

Buoys.—A red bell buoy, in 7 fathoms, lies in the fairway of the approach to, and half a mile outside, the bar, with the high lighthouse bearing S.E. $\frac{1}{4}$ E., and Cornborough summer-house S. by W. $\frac{1}{3}$ W. A conical black buoy lies on the bar at the edge of South sand, and marks the south limit of the channel; on the same side are two conical black buoys marking the Middle ridge and the Pulley, and beyond, on the north side of the channel, a black and white vertical striped can buoy marks the west extreme of Sprat ridge; the channel thence is direct to Appledore pool, in which is a black mooring buoy.

LIGHTS.—**Tidal signals.**—Bideford lighthouse, painted white, with a red vertical stripe, stands near the high-water mark of the south-west extremity of Braunton burrows. From the upper, or inner lighthouse, 86 feet high, is exhibited, at an elevation of 93 feet above high water, an *occulting white* light, with an eclipse of *two seconds duration every half minute*, and visible 14 miles in clear weather, between the bearings of E.N.E. and S.S.E. From S.S.E. (over Baggy leap and Asp rocks) to W. $\frac{1}{4}$ S., the light is obscured. Between W. $\frac{1}{4}$ S. (through north) and E.N.E. a light of less power is apparent for harbour navigation.

The lower, or outermost light, 311 yards from the upper one, is exhibited from a hut, painted white, with a red vertical stripe, 15 feet high, placed upon a tramway, to admit of its being moved northward or southward, so as to mark with the upper light the varying direction of the seaward channel. The light is *fixed white*, 44 feet above high water, and visible 11 miles between the bearings of East and S.S.E. $\frac{3}{4}$ E.; it is exhibited from half-flood to half-ebb, or while there is a depth of 15 feet over the bar.

By day a red ball is hoisted on a flagstaff at the low lighthouse to indicate the same depth.

Tides.—It is high water, full and change, at Appledore at 5h. 58m., local time, springs rise 23 feet; at Bideford bridge 6h. 7m., springs rise 16 feet; and at Barnstaple bridge 6h. 28m., springs rise 10 $\frac{1}{2}$ feet. During westerly gales the tide flows longer and rises higher. For Greenwich time add 17 minutes.

Pilots may always be obtained in moderate weather by hoisting the ordinary signal but they are unlicensed, are subject to no con-

trolling board, and make their own charges. They reside at Appledore. Clovelly fishermen often act as pilots for Barnstaple bar.

Directions.—There will generally be found over Barnstaple bar a depth of 27 feet at high-water springs, and 21 feet at high-water neaps. Strangers should never attempt it except in daylight; a sailing vessel requires a commanding breeze, for the tidal stream in the narrow parts of the channel sometimes runs at the rate of 5 knots per hour, with a disposition on the flood to split its course towards Barnstaple, whereby a vessel unskilfully handled would incur the risk of being swept upon the Crow or Sprat ridges.

The heavy cross-sea which often exists upon Barnstaple bar, even in moderate weather, renders the passage across it generally dangerous, except under the guidance of a pilot; but assuming one cannot be obtained, and that the ball at the low lighthouse has indicated a sufficient depth, the following directions should be carefully attended to:—

Having closed the fairway buoy, bring the lighthouses in line and steer for them, which will lead across the bar in the deepest water, and northward of the Bar and Middle ridge buoys; from abreast the latter, edge a little to the southward for a quarter of a mile, until the easternmost of two old mills near Northam is seen over Watertown, bearing S. $\frac{1}{3}$ W., which mark leads between the Pulley and Sprat ridge buoys; on passing the latter, the course must be quickly altered to the eastward, so as to bring the Bungalow house at Instow in line with, and under, Worlington houses upon the hill-top, bearing S.E. by E. With this mark kept on, a vessel may anchor in Appledore pool as soon as Northam church is shut in behind the Customs watch-house at Appledore, bearing S.W. $\frac{1}{4}$ W.

Appledore pool (beyond which no vessel should attempt to go, except under pilot charge) is about 3 cables in length by two-thirds of a cable in width, with depths of $2\frac{1}{2}$ to 5 fathoms. Vessels lie afloat here, but the nature of the ground is indifferent at the lower end, and the anchor is likely to come home unless a good scope of cable is promptly given, especially as the stream runs at the rate of 4 knots. The Pool is a valuable stopping place for vessels bound either in or out, and as pilots are not to be procured outside the bar in severe weather, when they are most required, it is of the utmost importance to be able to take up unassisted the first sheltered anchorage within the bar. Caution is necessary in entering to avoid the limestone heaps, which are scattered about the shore in the bight just below the Customs watch-house.

BARNSTAPLE contained in 1881 (date of last census) a population of 12,282; the number of vessels belonging to Barnstaple is about 50 of 2,000 tons. The number of vessels entering annually coastwise with cargoes, including Bideford, is about 2,200, and of the aggregate tonnage of 106,000 tons.

At **Bideford**, where is resident a vice-consul for the continental states, are several ship yards, in which vessels of 1,000 tons have been built, but it has no graving-dock or basin. A steam-vessel plies twice a week to Bristol; and Bideford is connected with Barnstaple and the adjoining districts by the South Western railway. The number of vessels belonging to the port is about 80, of the aggregate tonnage of 5,000 tons. The population of Bideford in 1881 amounted to 6,499.

At **Appledore** there are also several building and repairing yards; also two dry docks. Population in 1881, 648.

Docks.—The Richmond graving-dock is of the following dimensions:—length over all, 323 feet; on blocks, 313 feet; width of entrance, 43 feet; with a depth of 16 to 18 feet over the sill at high-water springs. Largest vessel docked, about 1,400 tons. Westcott dry dock is 280 feet in length over all; 260 feet on blocks; width at entrance, 43 feet; with depth on sill of 14 to 15 feet at high-water ordinary spring tides. There is also a patent slip 310 feet in length, with a breadth of 19 feet.

Lifeboats and life-saving apparatus are maintained on both sides of the entrance. (There are two lifeboats at Appledore, and one on Braunton sands.)

Coastguard stations are established at Appledore and Westward Ho.

Supplies.—Coal.—Supplies may readily be obtained at Appledore, but water in any quantity can only be procured at Lancross, a mile above Bideford bridge.

Small quantities of coal can be put on board a vessel lying in Appledore pool by lighters; there is no wharf accommodation.

Trade.—The principal imports are limestone from Wales, for the purpose of agriculture, culm, coal, and timber; and the exports, ironstone, clay, and clay ware.

Instow, situated near the shore opposite to Appledore, has a stone pier, hotels, and baths, and is a station of the Bideford railway.

Westward Ho.—Within the Pebble ridge of Northam burrows is a recently-established watering place called Westward Ho, including

an exposed pier, a large hotel, the United Services college for boys, and several conspicuous houses.

COAST.—Asp rock.—Braunton burrows, or sand-hills, terminate at a distance of $2\frac{1}{2}$ miles northward of Barnstaple bar at the abrupt point of Down hill, or Down end, as it is most commonly termed. Asp rock, about half a mile in extent, with a depth of 12 feet, and 5 to 7 fathoms within a short distance of it, lies off Down end; its outer extreme is situated with Down end bearing S.E. by E. distant one mile, and Baggy point N.E. $\frac{1}{4}$ E. Morte point kept well open of Baggy point leads clear westward of it.

Croyde bay, formed between Down end and Baggy point, has some high sand-hills on its south-west side, some lime-kilns on its north-east side, and a wooded valley at its head, in which is the village of Croyde. The bay is used as a temporary anchorage by coasting craft in off-shore winds and fine weather.

A detachment of coastguard is stationed at Croyde.

Baggy point and Leap.—Baggy point, between Croyde and Morte bays, is a bold and barren bluff with several deep caves near its extremity. Baggy Leap is a rocky shoal off the point, about three-quarters of a mile in extent, with one rock (Baggy rock) nearly awash at low-water springs, and others with from 15 to 19 feet, and deep water close to; it is separated from the point by a channel one-quarter of a mile in width, with a depth of 5 fathoms. The outer extreme of the shoal lies with the point bearing S.E. $\frac{1}{4}$ E., distant three-quarters of a mile. Although there is a depth of 10 or 11 fathoms, at a quarter of a mile from the shoal, a heavy breaking sea is formed in rough weather to the distance of half a mile. It is therefore desirable to give it a good berth by keeping Cornborough summer-house, bearing southward of S. $\frac{3}{4}$ W., or Bull point, open of Morte point.

Buoy.—A red conical buoy, marked Baggy Leap, lies in 8 fathoms, about one cable off the north-western extremity of Baggy Leap shoal.

MORTE BAY* lies between Baggy and Morte points; it is $2\frac{1}{2}$ miles wide, with a long stretch of sandy strand and foreshore, affording capital bathing, backed by high and cultivated slopes, and with some good houses at the outlet of the valley at Woolacombe Tracey. The village of Morthoe which is increasing in size and possesses a good hotel, lies in a dip in the hills eastward of Morte point. Population in 1881 was 430.

* See plan of Morte bay, scale, $m = 2\frac{1}{2}$ inches, on Admiralty chart, Trevose head to Bull point, No. 1,178.

With easterly and southerly winds, the bay affords good shelter in 7 to 8 fathoms over a clean sandy bottom, from one-half to three-quarters of a mile off shore, and within the strength of the tide. Upon any indication of a change of wind, sailing vessels should immediately weigh.

A Lifeboat, with life-saving apparatus, is stationed at Woolacombe Tracey in Morte bay; and a detachment of coast guard at Morthoe.

Morte point and stone.—Morte point is rocky and barren, sloping from the summit into low cliffs. Morte stone lies near the centre of the rocky ledge, which extends $3\frac{1}{2}$ cables west-north-westward of Morte point; it dries 24 feet, and is only covered at near high water springs.

Buoy.—A conical red buoy, with staff and globe, in 9 fathoms, lies a quarter of a mile off the ledge, with Morte stone bearing S.E. by E. $\frac{1}{2}$ E., distant 4 cables. In thick weather, while rounding the Stone, it is not safe to go into a less depth than 20 fathoms.

The ebb stream sets clear of Morte stone, but the flood across Morte bay sets directly over it; there is, besides, a dangerous race off the point in bad weather, which must be avoided.

COAST.—Rockham bay and shoal.—Between Morte point and Bull point, about one mile apart, is Rockham bay, a small indenture with a straggling rocky foreshore extending from one to 2 cables, which should be given a wide berth. Rockham shoal, the principal danger, is 3 cables in length, having 2 rocky heads near the outer extremity on which the depth is less than 6 feet at low water. From the shoalest water, Morte stone bears S.W. by W. $\frac{1}{2}$ W., distant 6 cables.

Clearing marks.—Rillage point and the foot of the rocks about Capstone hill at Ilfracombe, kept open of Bull point, bearing E. $\frac{1}{2}$ S., leads northward of Rockham shoal and Morte ledge. At night, keep in the *white* light shown from Bull point, as the *red* light is shown over these dangers.

BULL POINT LIGHT.—From a circular white lighthouse 55 feet high, erected on Bull point, is exhibited, at an elevation of 154 feet above high water, a *flashing white* light (*triple, half minute*), showing *three successive flashes* of about *two seconds* duration each, divided by intervals of about *three seconds* of darkness, the third flash being followed by an eclipse of about *eighteen seconds*.

A *fixed red* light is also shown from the lighthouse, 18 feet below the flashing light, between the bearings of E. by N. and S.E. by E. $\frac{1}{2}$ E., to mark the Morte stone and Rockham shoal.

Fog signal.—The fog siren, during thick or foggy weather, will give *three* blasts in quick succession every *two minutes*.

Lee bay.—From Bull point the coast trends nearly straight to Ilfracombe, a distance of 3 miles; it is bounded by high and steep slopes, intersected at Lee bay by a deep and well-wooded valley. The shore is skirted by foul ground, but there is a depth of 11 and 12 fathoms at an offing of a quarter of a mile. In Lee bay coasting vessels discharge limestone.

ILFRACOMBE* situated about 20 miles eastward of Lundy, has one of the most accessible dry harbours on the south side of the Bristol channel. The town, with its white terraces, houses, and pile pier, forms a striking object, but the harbour is not visible from the offing. At night, the *fixed red* light on Lantern hill (from the 1st September to the 30th April) and the three *red* lights on the pile pier will enable the entrance to be identified. Also prominent guiding features are the abrupt conical hills of Capstone and Helesborough, nearly three-quarters of a mile apart, with the entrance to the harbour about midway between them. Capstone hill, on the western side, with a coastguard flagstaff erected on it, is 154 feet high, and nearly bold-to sloping down towards Lantern hill, the west point of the harbour entrance; Helesborough, on the eastern side, is 420 feet high, and fronted by low-water rocks to the distance of a cable.

The town of Ilfracombe is a favourite summer resort, and has been much improved and enlarged during late years by the erection of several spacious buildings, and a promenade pile pier. Excursion steamers visit Ilfracombe from all the principal ports in the Bristol channel during the summer season.

Population in 1881, date of last census, was 6,254.

The Harbour, about 6 acres in extent (excluding the outer portion, which is an additional 4 acres), is formed under cover of Lantern hill and the narrow isthmus connecting it with Capston hill, aided by a transverse pier about 100 yards long to afford additional protection.

Upwards of 40 coasters may berth within shelter, without the risk of becoming neaped, there being 18 feet within the pier at high-water springs, and 12 feet at high-water neaps. The bottom is an

* See Admiralty plan of Ilfracombe, No. 1,158; scale, $m = 11.8$ inches.

easy slope, composed of a thin layer of mud over sand, and is well adapted for vessels provided with legs or bilge pieces for taking the ground.

In settled weather, vessels may lie aground in the outer compartment of the harbour, which has been formed by the construction of a quay from the inner end of the transverse pier to near the point of low water, affording a safe berthing place for steamers trading to the harbour, with wharfage 300 feet in length; from whence it is continued by a semi-circular promenade pile pier, embracing the eastern portion of the low-water rocks off Lantern hill. There is a buoy, for warping in and out, besides mooring buoys, posts, and rings in the inner harbour.

The harbour, which is easy of access, and has no outlying dangers, is used by coasters and steamers trading to Ilfracombe; vessels wind-bound, chiefly in the coasting trade; by pilot boats belonging to the Bristol channel ports, and by herring boats in the latter part of the year. Only 2 or 3 vessels belong to the place. About 900 small vessels enter the port annually, of the aggregate tonnage of 45,000.

Pile pier.—Light draught steam-vessels can go alongside the pile pier at all times of the tide, there being a depth of 6 feet at the landing at low-water springs; but the inner harbour quays dry from 7 to 10 feet. Tugs and pilot boats anchor just eastward of the pile pier, and find shelter from winds southward of West.

LIGHTS.—The harbour light is shown from a lighthouse built upon an old disused religious edifice on the summit of Lantern hill. The light is *fixed red*, 127 feet above high water, and exhibited all night from the 1st September to the 30th April, and should be visible in clear weather from a distance of 10 miles.

A *fixed red* light is shown on the inner pier-head from sunset to sunrise all the year round.

There are also three *fixed red* lights exhibited on the pile pier, one from each angle, from sunset to sunrise all the year round, which enable vessels to run into the harbour or anchorage at night; but there is no signal to denote the depth of water.

Pilots.—Harbour pilots are generally on the look out, but, as they use boats only, they are unable, in bad weather, to board vessels outside the port; but they are expert in directing vessels in, and then securing them. Pilots will also be found here for Cardiff and King road.

Tides.—It is high water, full and change, at Ilfracombe at 5h. 42m. local, or 5h. 58m. Greenwich time. Equinoctial springs rise 32 feet; ordinary springs 27 feet; and neaps 21 feet.

The stream of tide, within a quarter of a mile of this line of coast, makes to the eastward from low water till half-flood, and then to the westward until low water, thereby making 3 hours eastern set, and 9 hours western ; but farther off shore, in 20 fathoms, the regular streams set 6 hours each way, are slack about 20 minutes, and turn at the times of high and low water by the shore. The average rate of these outer streams is 3 knots per hour at springs, and 2 knots at neaps.

Anchorage.—In fine weather anchorage may be taken up in the Range, in 6 or 7 fathoms, over clean ground, about a quarter of a mile off shore, with the extreme of the pile pier S.S.W., and Bull point lighthouse showing just clear of Capstone hill.

Directions.—It is advisable not to approach Ilfracombe harbour until after half-flood, in order to avoid anchoring in the Range (the roadstead in front), as it affords no shelter with the wind to the northward of West, and the cross tide causes a short and confused sea. Small steam vessels have no difficulty in entering Ilfracombe harbour at any time, if the state of the tide permits, there being no dangers ; the pier may be approached quite close. At half-tide there will be about 19 to 20 feet water abreast and at the pile pier landing, but only 6 to 7 feet at the pier-head. Vessels secure either alongside the pier or to the mooring buoys in the middle of the harbour. When the inner harbour is full, vessels are berthed in the outer harbour, with an anchor out ahead and their sterns to the pier.

In the daytime, should a vessel about to enter require the use of the harbour warps, it will be necessary to hoist the colours at the fore, and if at night fire a gun and show a light ; then, should boats not be able to come out, stand in for the harbour, as assistance will be found immediately on rounding the pile pier.

Coastguard.—**Lifeboat.**—The lifeboat is always kept in readiness, and also the life-preserving apparatus, under the charge of the coastguard. Ilfracombe is the headquarters of the division of the coastguard for the district.

Supplies.—Stores, spars, sails, and ground tackle for coasting craft may be procured at Ilfracombe ; repairs can be executed to wooden vessels, but there are no facilities for repairing iron ones, and there is no dock accommodation. Water may be obtained from the mains of the Local Board from pipes laid on to the pier.

Coal.—About 20 tons of coal may be obtained and put on board alongside the quays.

COAST.*—Buggy overfall.—About one mile eastward of Ilfracombe is Rillage point, which is sloping and broken in outline, with an old mill just above it. A rocky ledge projects one-third of a mile north-westward of the point, rising abruptly from a depth of 10 fathoms in Buggy pit to 3 fathoms, and causing a heavy overfall, dangerous in westerly winds to small vessels; it may be avoided by keeping the beach at the head of Combe Martin bay in sight.

Watermouth.—Half a mile eastward of Rillage point is the entrance to the sandy cove of Watermouth, formed by a narrow point, named Burrow nose. About the centre is a short ruined tower or Dove cote, and at the head of the cove is Watermouth castle, so called. A small stream discharges into the cove.

There is a small boat pier; and although at times there is a considerable run of the sea, small disabled coasters would find a refuge if driven past Ilfracombe in a westerly gale. It is frequented by coasters of about 60 tons burthen.

Combe Martin bay.—From Watermouth the coast trends south-east, forming, with Little Hangman hill on the opposite side, Combe Martin bay, where vessels, in fine weather, will find temporary anchorage in about 8 fathoms. The village, with a population of about 3,600, is situated at the south-east angle of the creek, but only its north-west end and church are visible from the bay. Little Hangman hill is remarkable for its well defined conical shape, by which it may, in hazy weather, be distinguished from Helesborough at Ilfracombe. The silver lead mines here have been worked at intervals for several years.

Coastguard.—There is a detachment of Coastguard stationed here; and also at Martinhoe a few miles to the eastward.

From Little Hangman hill eastward to High Weer point, a distance of 4 miles, the coast is well marked by the Hangman and other high cliffs, the former of a deep red colour; the immediate back land is mountainous, Little Hangman and Great Hangman hills being respectively 756 and 1,083 feet above high water, and separated from a higher hill eastward of 1,187 feet elevation, by a deep gorge. The foot of the cliffs is bold-to, with the exception of a fang or two near Little Hangman point.

Copperas rock. about 50 yards in extent, with 4 feet least water, and steep to all round, lies half a mile northward of Great Hangman cliff; at times the sea breaks heavily upon it. Capstone hill open of

* See Admiralty chart:—Bristol channel, No. 1179; scale, $m = 0.5$ of an inch.

Rillage point, bearing West, or Holiday hill near Lynmouth open of High Weer point, E. by S. $\frac{3}{4}$ S., leads one-third of a mile northward of it. The Foreland, in line with High-weer point, leads between Copperas rock and the shore, in about $5\frac{1}{2}$ fathoms least water.

Buoy.—A conical black buoy, marked Copperas rock, lies in 12 fathoms, about one cable N.N.E. of the rock.

At the distance of $5\frac{1}{2}$ miles off High Weer point, and in a direct line for Swansea, is the eastern extreme of the depth of 20 fathoms at low water; this will assist in some measure to indicate the position of a vessel in thick weather.

High Weer point.—Bank.—A race extends half a mile off High Weer point; and E by S. $1\frac{1}{4}$ miles from the point, is a bank of sand with 16 feet at low water. Little Hangman hill, open of High Weer point, leads 2 cables northward of it.

Heddon's mouth, just westward of High Weer point, is considered one of the finest valleys in the county. It is enclosed by huge boundaries hung with wood, fern, and heather, and the rocks open at the shore like a gigantic mouth. A steep zigzag leads through pine woods to the village of Trentishoe. Exmoor of about 14 square miles, lies within this neighbourhood.

LYNMOUTH.*—The land from the Hangman heights declines considerably to the eastward, and the shore is more broken and clothed with wood to Boathaven and the romantic villages of Lynton and Lynmouth, $3\frac{1}{2}$ miles eastward of High Weer point, and between Holiday hill and the Foreland bluff. Lynton lies in an upper valley of the West Lyn, some 500 feet above Lynmouth. Its church and hotels are conspicuous objects from the eastward. Lynmouth, situated below the junction of the streams, is a pretty village of lodging houses. The neighbourhood of Lynmouth and Lynton is much frequented for the scenery; the Valley of Rocks, one mile to the westward, is one of the most interesting. The neighbourhood is said to be a paradise for anglers. Population of Lynton in 1881 was 1,213.

Lynmouth creek is fronted by a shelf of boulder stones, dry at low water to the distance of $2\frac{1}{2}$ cables. A narrow channel, scoured by the river Lyn, and marked on both sides by substantial posts, enables small vessels to warp up to the jetty, which has a depth of 15 feet alongside at high-water springs.

* See Admiralty plan of Lynmouth, No. 1,181; scale $m = 2.25$ inches, and Bristol Channel, No. 1,179.

Coasting steam-vessels trading between Bideford, Ilfracombe, and Bristol call off the port.

Coastguard.—Lifeboat.—A lifeboat, with rocket apparatus, is stationed at Lynmouth, which is also a coastguard station.

Lynmouth road affords anchorage with off-shore winds in from 4 to 6 fathoms, sand and gravel, out of the strength of the tide, at from a half to one mile off shore. Some slight protection in northerly winds is afforded towards low water by the sand ridge which fronts the road. The tidal streams run from 4 to 5 knots per hour seaward of this ridge; in the anchorage the flood runs about $1\frac{1}{2}$ knots, but the ebb is not felt there.

Sand ridge, so named although composed of gravel, is a dangerous detached bank lying westward of the Foreland, and in the approach to Lynmouth; it is one mile in length by $1\frac{1}{2}$ cables in breadth within the 3-fathom limits, with 5 to 6 fathoms at a short distance. Near its eastern extremity is a patch half a cable in extent, with only 4 feet water; at extraordinary low tides this patch has been observed awash. There is a channel a quarter of a mile wide between the sand ridge and the Foreland with 7 fathoms water.

Capstone hill open of Rillage point bearing West, leads $1\frac{1}{2}$ miles northward of the sand ridge.

Buoy.—A black conical buoy, with staff and globe, lies in 6 fathoms, at one cable N. by W. of the west extreme of the sand ridge, with Lynton church bearing S.S.W. $\frac{3}{4}$ W.

The FORELAND, situated 2 miles eastward of Lynmouth, and affording some shelter to the anchorage there, is the most prominent point on the south side of the Bristol channel; it rises abruptly from the shore to its summit of 734 feet elevation, and is divided from the higher ground within by a hollow or saddle, conspicuous as a mark from the east and west points of view. A rocky ledge with depths of 3 fathoms extends 2 cables from the bluff.

Foreland ledge.—Abreast the Foreland, three-quarters of a mile distant, is the west extreme of the Foreland ledge; this ledge of rocky ground is about $1\frac{1}{4}$ miles in length, parallel to the coast, with a least depth of $4\frac{1}{2}$ fathoms; between it and the Foreland the depth is from 6 to 11 fathoms, and close outside from 10 to 13 fathoms. In bad weather there is a dangerous overfall over and beyond this shoal; this will be avoided by keeping Capstone hill, at Ilfracombe, open of Rillage point, bearing West, which leads one mile northward of it; or by passing between it and the Sand ridge; here a stronger

race of tide may be experienced, but the vessel will escape the heavy breaking sea.

Soundings and tidal streams.—At distances of $2\frac{1}{4}$ to $3\frac{1}{2}$ miles off the Foreland there are holes of from 20 to 27 fathoms, rocky bottom. The water thence shallows to the Welsh coast, nor does such deep water again occur in the passage to the eastward, except in one or two holes about 5 miles farther up.

In mid-channel or fairway, the tides set fairly up and down, turning when it is high and low water by the shore, and running at an average velocity of $3\frac{1}{2}$ knots, with half an hour of slack. At $1\frac{1}{2}$ miles off shore the velocity is about 5 knots at springs, the direction of the stream being influenced by the trend of the coast; but within Lynmouth bay the tides are unequal in duration, and only about $1\frac{1}{2}$ knots in strength; the ebb running 3 hours, the flood and eddies $9\frac{1}{4}$ hours.

It is high water, full and change, at the Foreland at 6h. 2m. local time, or 6h. 17m. Greenwich. Ordinary springs rise 30 feet, and neaps 22 feet.

THE COAST from the Foreland eastward is nearly straight for 6 miles to Gore point, presenting a range of heights nearly 1,200 feet high and partly covered by wood; the shore is bold, there being 5 fathoms at low water 3 cables off, but inaccessible from the sea, except at a rough beach under Glenthorn house, which stands amongst wood close to the cliff, 3 miles from the Foreland. Here a stream divides the counties of Devon and Somersetshire.

PORLOCK BAY AND VILLAGE.*—Gore point, low and shingly, with Hurlstone point 2 miles distant, forms Porlock bay, in the western bight of which is the small village of Porlock weir, and quay. The village of Porlock proper, with its church, is about $1\frac{1}{2}$ miles inland, by the road; west Porlock lies about midway, and here a detachment of the coast guard is stationed. Population in 1881 was 765.

Though this bay is recessed but little within the points forming it, it is much frequented as an anchorage, as vessels can lie partly out of the strength of the tide in 5 fathoms, at half a mile off shore; the beach of boulder stones has a gradually decreasing depth towards it. A fertile valley, breaking the chain of heights, extends inland for about 3 miles to the high range of Dunkerry, the summit of which is 1,678 feet high, and is the highest land visible from seaward on the south side of the Bristol channel, or in the county of Somerset.

* See Admiralty plan of Porlock, No. 1,181; scale, $m = 2\cdot25$ inches.

Porlock weir is a small indentation with dock gates 30 feet wide, capable of taking a vessel of 12 feet draught, at high water ; or a few smaller vessels. This indent admits of considerable improvement at little cost, but the trade here is not sufficient to make the work remunerative.

Hurlstone point and Minehead bluff.*—The craggy point of Hurlstone or Bossington is the western termination of a high ridge named North hill, which extends to the eastward for 4 miles to Minehead harbour, its boldest projection being Minehead bluff. Shallow water extends about a quarter of a mile off shore to Greenaley point, thence increasing to about half a mile off Minehead, interspersed with boulder stones and rocky spits ; the Foreland kept in sight, or, in thick weather, a low water depth of 10 fathoms maintained, leads clear of all danger.

MINEHEAD HARBOUR† is the first place to the eastward of Ilfracombe that affords shelter to the coaster with on-shore winds, very few spots of the intervening 24 miles of iron-bound coast being even accessible to a boat at that time ; and though it is of no importance as a trading port, compared with its former consequence, it is well known to the Bristol channel coasters.

The harbour is formed by a pier, consisting of a single arm, curving to the east and south-east, the parapet and outer end being whitewashed so as to make it more easily discernible ; it will berth about 20 coasters at one time. The harbour is easy of access, and offers a safe refuge from the chopping sea produced by the western tide and northerly winds. The foot of the pier-head dries 9 feet at low water springs ; this will give a depth of 7 feet at half tide, not less than 18 feet from three-quarters flood until the first-quarter ebb, and 23 feet at high water springs ; at neaps there will be 15 feet at high water.

The town of Minehead, designated as Upper, Lower, and Quay towns, opens out under the eastern extremity of the North hill.

Population in 1881 was 774.

Tidal Light.—A *fixed green* tidal light (gas lamp) is exhibited, at an elevation of 19 feet, from the extremity of Minehead pier, from 3 hours before to $2\frac{1}{2}$ hours after high water, visible in clear weather from a distance of 4 miles.

Tides.—It is high water, full and change, at Minehead pier at 6h. 24m. local time, or 6h. 38m. Greenwich. Equinoctial springs rise

* See Admiralty chart of Bristol channel, Nash point to New passage, No. 2,682 ; scale, $m = 1\cdot0$ inch.

† See Admiralty plan of Minehead, No. 1,181 ; scale, $m = 2\cdot25$ inches.

37 feet ; ordinary springs 32 feet ; and neaps 24 feet. The ebb stream makes westward past the pier an hour before high water on the shore.

Pilots.—There are no regular pilots, but hobblerers are always on the look-out to render assistance.

Coastguard.—There is a coastguard station at Minehead.

Directions.—Approaching the harbour from the westward, and there being sufficient water to enter the harbour, pass Greenaley point and the White mark at the high water line at about 2 cables distance, and continue on until the east end of Quay town opens of the pier-head, and then to haul as sharply round the latter as possible, having a stern anchor ready to let go, if the vessel be likely to shoot a-head too much, or the space within the pier be crowded. If the vessel is flat, it is preferable to lie on the mud free from the pier, securely moored with the head in and stern out ; but as legs will not act, a sharp vessel should lay alongside the pier, being careful to keep clear of it at the top of the tide, to avoid the chafe which results from the strong under-tow during “north-westerns ;” the sea also breaks over the pier in gales at the top of a spring tide.

If approaching Minehead during the young flood, it will be necessary to keep to the westward of Greenaley point until there is sufficient water at the pier, so as to avoid driving on the rocky shelf which extends half a mile off it. In moderate weather a vessel drawing about 10 feet, may anchor over good ground between the outer spit and the shore, abreast the White mark placed there for that purpose, with Minehead bluff just open of Greenaley point, and Dunster Gazebo (a conspicuous tower on a wooded hill eastward of Minehead) in line with the pier-head.

Supplies of the ordinary description, with water, can be procured. A small quantity of coal may be put on board from alongside the pier.

Trade.—About 10 small vessels belong to the port ; the number which entered in 1888 was 203, of the aggregate tonnage of 9,182 tons ; from 70 to 100 enter for shelter only. The number of inhabitants in 1881 (last census), was 1,774. The value of the exports and imports amount to £4,000.

BLUE ANCHOR ROAD.—The coast from Minehead to Blue Anchor head, a distance of 4 miles, is low and flat. The low-water shore dries out about half a mile, and is rocky, except just westward of the head, where, and along the edge of the foul ground a layer of mud has frequently saved vessels compelled to run on shore. This is a valuable resource for small coasting vessels riding in the road, where the holding ground is of tenacious blue clay, for if deeply

laden, and caught with a sudden shift of wind to the north-west, they may, to prevent being swamped, have to slip, and either seek shelter at Watchet, or safety by running upon the mud.*

A good berth in Blue Anchor road is in 4 fathoms, with Minehead pier N.W. by W. $\frac{1}{4}$ W., and Blue Anchor house (the nearest to the cliff) S. by W. $\frac{3}{4}$ W.

From Blue Anchor head to Watchet the cliffs give a bold appearance to the coast, but the low-water rocks dry one-third of a mile out.

WATCHET HARBOUR† is situated about 2 miles eastward of Blue Anchor head, or $5\frac{1}{2}$ miles from Minehead. Its piers afford a quay space of about 800 feet in length, enclosing an area of about $9\frac{1}{2}$ acres, with a width at entrance of about 100 feet, in which there is a depth of about 23 feet at high water springs, and 14 feet at neaps. There is from 5 to 10 feet less water at the inner quays. The rocky foreshore fronting the entrance dries off nearly half a mile at low water. Good accommodation is thus afforded to the coasting trade, with the advantages of the railway extending on to the piers.

LIGHT.—**Tidal signals.**—On the end of the west pier-head stands a lighthouse, 22 feet high, with a white top, red middle, and black base, from which is exhibited, at an elevation of 30 feet, a *fixed red* light visible 4 miles, when there is 8 feet water in the entrance on the flood, until reduced to 10 feet on the ebb. A ball is hoisted by day during the same period.

A *fixed red* light is also shown from the short arm extending northward from the west pier head.

Directions.—The soundings shoal very gradually in approaching Watchet by the lead, there being 5 fathoms, sand, at $1\frac{1}{2}$ miles off, and 3 fathoms at half that distance. There is no difficulty in entering the harbour, when there is sufficient water; the depth in the entrance when over 8 feet, is shewn from the lighthouse, as before stated, but the tidal streams run from 4 to 5 knots an hour at springs at one mile off, and must be allowed for. Round in between the pier-heads, and moor in the way that is recommended at Minehead (page 73), observing that, if the weather be moderate, legs may be used. There is a considerable scend here at times during strong winds, which makes it uncomfortable for vessels when about to take the ground.

Trade.—The number of vessels belonging to Watchet is about 30, of the aggregate tonnage of 1,500 tons; the number entering and

* See Admiralty chart:—Nash point to New Passage, No. 2,682.

† See Admiralty plan of Watchet, No. 1,181; scale, $m = 2.25$ inches.

clearing annually being about 550 of 28,000 tons. Population in 1881 was about 1,600.

Coastguard.—A Lifeboat is stationed here, and a rocket apparatus is kept at the coastguard station on the cliff, just eastward of the harbour.

Tides.—The ebb stream between Minehead and Watchet makes one hour before high water by the shore; and the mid-channel streams sets up and down at the rate of 5 knots on springs, and 3 knots at neaps, turning at the times of high and low water, with about half an hour of slack.

COAST.—**Stoke spit, and patches.**—Cliffs of a variegated colour extend from Watchet for 7 miles to the eastward. West Quantockshead church, with a fine square tower and small spire, is a very prominent object on the slope within. The low-water feature dries out one-third of a mile along the shore to Stoke bluff, off which is Little Stoke spit, consisting of round stones terminating in sand, and extending in a north-west direction, nearly dry for one mile; a flat extends a quarter of a mile beyond the spit, having a depth of 7 to 12 feet.

Kilve patch lies $1\frac{8}{10}$ miles N.W. by N. from Stoke bluff, with $2\frac{1}{2}$ fathoms over a rocky head; several patches of about 3 fathoms lie eastward and westward of it, but all within the 5-fathoms line.

Cobbler patch, with 7 feet water, lies about 3 miles eastward of Kilve patch, or $1\frac{1}{2}$ miles West from the Gore buoy, approach to Bridgewater.

North-west patches, with from $2\frac{1}{2}$ to 3 fathoms, lie from 7 to 9 cables north-westward of the Cobbler, within the 5-fathoms line; they form the western extreme of the flats extending from Gore sand.

Clearing marks.—The church or piers at Watchet, bearing W.S.W. lead half a mile westward of Kilve patch; and, at night, Burnham lights in line E. by S., southerly, lead the same distance northward of it. These lights in line lead midway between the Cobbler and North-west patches, to the Gore bell buoy.

BRIDGEWATER BAY and RIVER PARRET.*—Bridge-water bay occupies the space between Stoke bluff and Brean down a distance of about 10 miles, the greater portion being filled by mud and sand which dries 4 miles out at low water. The Parret rises in Dorsetshire, and has a general northerly direction for 36 miles; it passes through the town of Bridgewater, and thence, with a very

* See Admiralty plan of Bridgewater port, No. 1,157; scale. $m = 2.7$ inches.

circuitous course of 12 miles, to Burnham, on the shore of the bay. Its principal affluents are the Ivel and Tone, on the west; the Yeo, and Brue near Burnham, on the east bank.

Bridgewater bar.—Between the Stert flats, and the Berrow and Gore sand, is the entrance to the river Parret. Its bar, situated $3\frac{1}{2}$ miles off Burnham, is half a mile in width between the buoys, one mile in length, with a depth of about 3 feet at low water springs, 20 feet at half-tide, 29 feet at high-water neaps, and 38 feet at high-water springs. The channel is considerably narrower at low water farther in, with depths varying from 5 to 11 feet, the latter depth only in pools. Above Fenning island the channel is winding and nearly dry. Short vessels of about 10 feet draught can lie afloat in a pool of about that depth just above Burnham. Vessels of about 15 feet draught can, at near high-water springs, proceed to Bridgewater, 15 miles above the bar, and enter the wet docks. Springs rise only 18 feet at Bridgewater.

There are numerous fishing weirs over the flats and along the edges of the channel; and the shallows without the bar are further dangerously obstructed by similar stakes, some being 9 inches in diameter, which only cover at half-tide.

Stert flats fill the whole of the southern portion of the bay, between Inkley and Stert point. The channel edge of this flat is composed of rock covered with sand, and a detached bed of shingle known as Chisel rocks, which cover at one hour flood; from thence, the Lark spit, and upwards to Fenning island the edge is of sand, covering at $1\frac{1}{2}$ hours flood; all above Fenning is mud.

Gore sand forms the north side of Bridgewater bar; its highest portion, one mile off Berrow, dries 32 feet, and therefore only covers near high-water springs: its western extreme is $3\frac{3}{4}$ miles distant from Burnham low lighthouse. From the Gore sand to Brean down the coast is fronted by Berrow flats, to the distance of one mile; at Brean down the sand and mud dries out to within 2 cables of the extreme point.

LIGHTS.—Burnham lighthouses, within Bridgewater bar, are situated about 6 cables north of Burnham village. From the upper, a white tower with a red vertical stripe, 99 feet high, situated one quarter of a mile within the shore, is exhibited, at an elevation of 91 feet above high water, a *double occulting white* light, visible in clear weather from a distance of 15 miles. Eastward of the bearing S.S.E. $\frac{1}{4}$ E., the light is obscured.

The light is under occultation twice in quick succession every minute, as follows:—Light, 54 seconds; eclipse, 2 seconds; light, 2 seconds; eclipse, 2 seconds.

From the lower lighthouse, a square white tower, with a red vertical stripe, 36 feet high, situated just without the high water line, E. by S. $\frac{1}{4}$ S., distant 500 yards from the upper one, is exhibited at an elevation of 23 feet above high water, a *white* and *red fixed* light, visible 9 miles between certain bearings.

The *white* light is visible between the bearings of E. $\frac{3}{4}$ S. and E.S.E., or over the bar; the latter bearing leads $1\frac{1}{4}$ miles southward of Culver sand. The *red* light, shown from the same tower, is visible from seaward between the bearings of E. $\frac{3}{4}$ S. and E. $\frac{1}{4}$ S.; also up the river, between the bearings of N. by E. and N. by E. $\frac{1}{2}$ E.; the outer limit of which clears the landing stage, and leads up to Highbridge river point buoy. The lights in line, *white*, bearing E. by S. southerly, lead one cable northward of the Gore bell buoy, situated in the fairway.

Buoys.—The first or fairway buoy off Bridgewater bar is the Gore, a conical bell buoy, painted black, with staff and globe; it lies in 12 feet at low-water springs, with Burnham high lighthouse open its width south of the low lighthouse E. by S., and Flatholm island lighthouse bearing N.N.E. The northern side of the channel within the bell buoy, the edge of Gore sand, is marked by three black can buoys, and one white can buoy; the latter being the inner one. The southern side of the bar channel is marked by three red can buoys; their positions will be best seen by referring to the plan, also that of two smaller red buoys northward of Stert island, making the south side of a swatch.

The white buoy on the northern side marks the swatch across the Gore used by light-draught steam-vessels crossing to and from Cardiff, when the state of the tide admits. The mark for crossing is Flatholm lighthouse in line with the east end of Steepholm, as far as the buoy, then northward of Chisel rocks and of the red buoys northward of Stert island.

Tides.—It is high water, full and change, at Bridgewater bar at 6h. 50m., local time; springs rise 35 feet, neaps $26\frac{1}{2}$ feet; the flood and ebb streams set obliquely, S.E. and N.W., across the channel, with a velocity of about $3\frac{1}{2}$ knots at springs. And at Bridgewater at 8h., or 8h. 12m. Greenwich time, with a rise of 18 feet on springs.

Bore.—Like most of the rivers opening into the Bristol channel, the Parret is subject to a bore at the first of the flood, but not to so

great an extent as formerly, if old records are to be trusted. Now it seldom rises more than 2 feet at spring tides, and only common attention to the moorings is necessary to prevent damage. The bore is scarcely distinguishable at neap tides.*

Pilots.—There are about a dozen pilots for the Parret, their license embracing from the outer limit of the port to Bridgewater town. They are seldom to be obtained outside Gore sand, and consequently, in the great majority of cases, vessels must find their way to Burnham before they can obtain one.

DIRECTIONS.—The approach to Bridgewater bay and the situation of the bar will, at a distance, be readily identified by Brent knoll, a table-topped hill rising abruptly above the surrounding flat country to an elevation of 437 feet; it is 2 miles within Burnham lighthouses, and upon their exact line of bearing; south Brent church with its square tower lies at the foot of the hill.

Coming from the westward, the highest shoulder of this hill should be brought to bear E. by S. $\frac{1}{2}$ S., which will lead in the fairway between Culver sand and the foul ground extending off Stoke bluff; a safe offing can be kept with Flatholm on the bearing of N.E. $\frac{1}{2}$ E. if there is not sufficient water on the bar, but it is advisable to anchor in that case.

At half-tide, there will be a depth of 20 feet on the bar, as before stated, and somewhat better water in the river; steer in with Burnham lighthouse in line bearing E. by S., southerly, which will lead just northward of Gore bell fairway buoy. From abreast this buoy, open the upper lighthouse southward of the lower one, passing between the red and black buoys. (The two inner black buoys and the white buoy on same side of channel should be passed close to.) From abreast the inner black buoy, Flatholm will be seen opening eastward of Steepholm, and the vessel will be approaching the northern edge of Chisel rocks; then edge to northward (passing close southward of the white buoy) until the upper light is open three times its breadth northward of the lower one; this course will clear Chisel rocks and Lark spit. A little curve in the course must then be made until the lights are again in line, and Burnham church brought to bear S.E. by S., when steer for the church for a short distance, thence following the bend of the river.

* On Saturday morning, November 13th, 1875 (when the tide had been falling for nearly an hour at Bridgewater), a tidal wave, reported to be from 8 to 10 feet in height, swept suddenly up the river Parret, bursting open the dock gates, and passing along the quay, forced many coasting craft from their moorings. One of these filled, and others were much injured, but no lives were lost.

The lead should be kept going on both sides of the vessel in order to preserve the deepest water, and care taken to counteract the increased influence of the oblique tide setting towards Stert island.

Anchorage in river.—Off Burnham church, anchorage may be taken up with Berrow church half-way between the western summit of Brean down and its extreme point. If the vessel be short and not exceeding 9 or 10 feet draught, she will lie afloat in the pool, a little above the pier, otherwise she should haul over towards the Stert and ground about half-tide, as at the anchorage there will not be sufficient room to swing round with the first of the flood, and grounding there would expose her to strain from the violent rush of tide.

At night.—At half-flood there is no danger in the approach to Bridgewater bar to vessels that can enter the river. Steer in with Burnham lights in line, bearing E. by S., southerly, as far as the Gore bell buoy, from whence the services of a pilot should be obtained.

From Burnham to Bridgewater the services of a pilot are absolutely necessary. The river is nearly dry at low water, and fishing stakes cross the stream in several places, which are rendered the more dangerous by the rapid tide. There are three places where vessels proceeding up may take the ground with safety, viz., on a layer of muddy sand just above Black rock; the next, a little above Combwich pill; and, thirdly, off the Dunball brick-works.

Steam-tugs will generally be found waiting near Burnham.

BRIDGEWATER.—Docks.—At Bridgewater there are wet docks connected with Taunton by a canal having 5 feet water. The width of the gates is 32 feet, and the depth over the sill 15 feet, capable of passing vessels of 500 tons; the total area amounts to about 4 acres. There are cranes on the side of the dock, one equal to an 8-ton lift, and others equal to 6 tons on the quay; also steam cranes in different parts of the river quays.

There is also a dry dock 108 feet in length, 24 feet breadth of entrance, with depth on blocks of 9 feet; and a gridiron at side of river 162 feet in length.

An iron bridge crosses the Parret at Bridgewater above the navigation, and the town is connected with the Bristol and Exeter railway.

There is a shipbuilding yard, and extensive brick and tile works. The chief exports are bricks, tiles, timber, and cheese; and the imports grain, hemp, coal, hides, and timber.

In 1882 there belonged to the port 132 vessels, of 8,259 tons ; and in 1888, 2,982 vessels, representing 187,915 tons, entered. The population in 1881 (last census) amounted to 12,637.

Supplies.—Coal.—Vessels may be supplied with coal in the wet dock at Bridgewater, at about 2s. 6d. above Cardiff prices. Repairs to wood and iron ships and to machinery are effected.

BURNHAM is situated on the right bank of the river, 5 miles within the bar ; its leaning church tower is a conspicuous object. There is a custom-house, and the hotels and houses fronting the beach offer accommodation to many who frequent the place for sea bathing.

Pier.—At the south end of the village, a pier or causeway extends out to near the low-water mark. At the end, which at high water affords a depth of 4 fathoms, a *red* light is shown from a pole when required. By excavation of the mud along the upper side of the pier, a basin is formed for the accommodation of traders, and a railway connects the pier with the station at Highbridge.

During the summer months there is daily communication with Cardiff by steamer, the times varying with the tide.

Lifeboat.—Near the pier a lifeboat is stationed.

CULVER SAND.*—Abreast Bridgewater bay, and about midway between the English and Welsh coasts, lies Culver sand, $4\frac{1}{2}$ miles in length in an east and west direction, within the 3-fathom limit, by $2\frac{1}{2}$ cables in width. It is composed of hard sand, with small patches of gravel at its western extremity, and its centre portion, over a distance of 3 miles, dries from 3 to 8 feet at low-water springs. The north and south sides of the sand are steep-to, the water shoaling rapidly from 6 fathoms. The flood tide from the direction of the Nash, sets directly across the sand, as does the returning ebb from Bridgewater bay.

Buoys.—Culver sand is marked by three buoys ; West Culver buoy is spherical, red and white in horizontal stripes, with staff and diamond ; it lies in $4\frac{3}{4}$ fathoms, one quarter mile west of the 3 fathoms edge, with Nash high lighthouse bearing N.N.W. $\frac{1}{4}$ W., distant $11\frac{8}{10}$ miles.

North Culver buoy is conical, red, in about 4 fathoms, close off the north edge of the sand ; it lies midway between East and West Culver buoys, or with West Culver bearing W. $\frac{3}{4}$ N., distant $2\frac{7}{10}$ miles.

East Culver buoy is spherical, red and white in horizontal stripes,

* See Admiralty chart :—Nash point to New passage, No. 2682.

with staff and triangle ; it lies in about $4\frac{1}{2}$ fathoms, at one quarter mile eastward of the 3-fathom edge of the sand, with North Culver buoy bearing West, distant $2\frac{6}{10}$ miles, and Gore bell buoy S. $\frac{1}{4}$ E., distant 4 miles.

FAIRWAYS.—Leading marks.—On each side of Culver sand there is a channel about 3 miles wide, up to Steephholm. The northern one, bounded by the One-fathom bank, has a general depth of 6 to 8 fathoms, with patches of $4\frac{1}{4}$ to $4\frac{3}{4}$ fathoms in places ; the line of best water, not less than $5\frac{1}{4}$ fathoms at low-water springs, is with Anchor head a little open southward of Steephholm, bearing E. $\frac{1}{3}$ S.

In the southern channel the depths decrease from 6 or 7 fathoms to 4 and 5 fathoms, over and between the Graham banks. The line of deepest water between the Graham banks and Culver sand, not less than $4\frac{1}{2}$ fathoms, is the new church of Weston-super-mare in line with Brean down point bearing E. $\frac{5}{8}$ N.

At night the Nash lower light kept in sight leads $1\frac{1}{2}$ miles westward of West Culver buoy ; and Burnham low light in sight leads about the same distance to the southward of it.

STEEPHOLM.—This island is $3\frac{1}{2}$ miles east-north-eastward of Culver sand, and abreast Brean down distant $2\frac{1}{2}$ miles ; it is $4\frac{1}{2}$ cables in length by 2 cables in breadth, having an elevation of 239 feet. Steep cliffs render it inaccessible, except at its eastern end, where a spit of shingle dries out $1\frac{1}{2}$ cables, and on which are some large fishing stakes. At this end of the island are two or three houses ; also recently constructed batteries.

Ledges extend $2\frac{1}{2}$ cables off the east and south-west extremities ; and 3 cables N.W. by W. from the Rudder, or western point of the island is a detached patch of $3\frac{1}{2}$ fathoms, with deep water between ; the island, is otherwise bold-to at the distance of half a cable. There is a depth of 5 to 7 fathoms over mud and sand between Culver sand and Steephholm ; of 3 to 9 fathoms over foul ground between the island and Brean down ; and 6 to 17 fathoms over a rocky bottom between Steephholm and Flatholm.

A rocky patch, with a least depth of 3 fathoms, and 6 to 7 fathoms at a short distance, is situated in the fairway eastward of Steephholm, with the north extreme of that island bearing W. by N $\frac{1}{4}$ N., and its nearest point distant $1\frac{1}{2}$ miles. Wick St. Lawrence church in line with north end of Bairnbach islet, bearing E. $\frac{1}{2}$ N., leads one quarter mile southward of the shoal.

Tides.—It is high water, full and change, at Steepholm, at 6h. 54m. local, or 7h. 6m. Greenwich time. Equinoctial springs rise 42 feet, ordinary springs 38 feet, and neaps 29 feet. Both streams run from 2 to 4 knots per hour in the vicinity of Steepholm.

The description of the southern shore of the Bristol channel is continued on page 192.

CHAPTER IV.

BRISTOL CHANNEL, NORTH-WEST APPROACH. — OFF- LYING ISLANDS AND ROCKS.—NORTH SHORE.—WOOL- TACK POINT TO WORMS HEAD.

VARIATION IN 1891.

Smalls Lighthouse and St. Ann's head	-	-	19° 50' W.
Worms head	-	-	19° 20' W.

Having described the approach to the Bristol channel, pointed out the value of Lundy island as a place of refuge in heavy weather, and given sailing directions for the southern shore as far as Steepholt; the northern shore to the same point, which includes the usual track taken by vessels bound to King road, will be described before proceeding up the Severn.

MILFORD HAVEN APPROACH, FROM THE WESTWARD.*

OFF-LYING ISLANDS AND ROCKS.—THE SMALLS ROCKS, on the highest of which there is a lighthouse, form the outer danger in the approach to Milford Haven, from the westward.

This low cluster of rocks, with deep water close to, covers a space of half a mile in extent, in a north-east and south-west direction, by about 3 cables in breadth, and with the exception of the lighthouse rock and two others just eastward of it, are all covered at high water. The lighthouse rock is 130 yards in length at low water.

The light, situated about $18\frac{1}{2}$ miles westward of St. Ann's head, entrance to Milford Haven, is usually the first object made by vessels from the westward.

South-west rock, the south-western extremity of the group, dries 5 feet, and lies S.W. by W. $\frac{1}{2}$ W., 3 cables from the lighthouse.

* See Admiralty charts :—England, west coast, Bristol channel to New Quay, No. 1,410 ; scale, $m = 0.5$ inch ; and, St. Ann's head to St. Bride's bay, including the Smalls, Grassholm, and the adjacent islands, with plan of Jack sound, No. 1,488 ; scale, $m = 1.94$ inch ; Bristol channel, No. 1,179 ; scale, $m = 0.5$ inch.

East rock, awash only at low-water spring tides, lies one-quarter of a mile, S.E. by E. $\frac{1}{2}$ E. from the lighthouse, and one cable within it is a rock which dries 4 feet.

North-east rock, situated 2 cables N.E. $\frac{1}{4}$ N. from the lighthouse, dries only at low-water springs, and is steep-to on its northern side.

On the west side of the Smalls lighthouse there are no off-lying dangers.

The landing-place, used only by the Trinity House boats supplying the lighthouse with stores, is on the south-east side, and receives some protection from the southern ledge of high-water rocks, which form a sort of cove at low water, but when the tide is up the water flows through. A safe landing can seldom be effected ; when practicable, and anyone wishes to land, a ball is hoisted on the lighthouse, and, if impracticable, an ensign.

LIGHT.—Upon the largest of the Smalls rocks is a circular stone lighthouse, painted red and white in horizontal bands, from which is exhibited, at an elevation of 125 feet above high-water, an *intermittent* light, giving two occultations every minute in the following order :—Light, 54 seconds ; eclipse, 2 seconds ; light, 2 seconds ; eclipse, 2 seconds, visible in clear weather from all directions at a distance of 17 miles. The light shows *white*, except between the bearings W. $\frac{1}{3}$ N. and N.W. $\frac{3}{4}$ W., or covering the Hats and Barrels, where it shows *red*.

Fog signals.—The signal is an explosive fog signal, which, during thick or foggy weather, will give *one* report (sounding like the discharge of a gun) *every five minutes*.

Distress signals.—Should assistance be required at the lighthouse, or by passing vessels, the signal will be a Call rocket of great brilliancy, showing a magnesium flame in falling, as well as a vivid rising trail ; this rocket, which will only be used at night and in clear weather, will be fired at frequent intervals.

Tidal streams.—At the Smalls it is slack water at the times of high and low water at the entrance to Liverpool, or about 20 minutes before the times given in the tide tables for Liverpool. The stream sets past the rock in a S. by W. $\frac{1}{2}$ W. direction whilst the water is falling at Liverpool and in the opposite direction when rising at Liverpool, and at the rate of about 5 knots at springs, and 2 to 3 knots at neaps. South-eastward of the Smalls, the southerly stream (ebb from Liverpool) sweeps in a broad curve south-eastward, entering the Bristol channel as a flood stream with the same velocity,

and making high water in the outer portion of the Bristol channel ports, when it is low water at Liverpool nearly. The northerly stream from the Smalls (flood to Liverpool) causes low water in the Bristol channel. *See also page 14.*

Between the Smalls and Grassholm the streams begin about half an hour earlier, and between Grassholm and the coast one hour earlier, with little or no slack water at springs.

Their rate varies from 2 to 3 knots, but over the Hats and Barrels and through the channels the velocity is increased to 5 knots at springs. There are always eddies about these shoals, stronger or weaker of course, according to the period and rise of the tide, but requiring much skill and experience to be rendered available. Coasters often make good work when in the wake of the rocks, but are rapidly swept to leeward upon opening the different passages.

It is not safe to play with these channels between the shoals, and they are better avoided, except at slack water, weak tides, or with steam power.

It is high water, full and change, at the Smalls, at 6h. 0m. local, 6h. 23m. Greenwich time; the rise of spring tides was estimated at 19 to 21 feet; perhaps 17 feet would be nearer the truth, and 10 or 12 feet as the mean rise of neaps.

Depths westward of the Smalls.—Outside, or westward of the Smalls, there is nothing to be guarded against, the lighthouse rock being steep-to, and it is, therefore, only necessary when there to be guided by the general directions for St. George's channel. *See page 5.* It may, however, be well to remark that with a less depth than 42 fathoms (reduced to low-water) the mariner may be sure that he is within a line drawn from $1\frac{1}{2}$ miles outside the Smalls to the same distance outside Bais bank; and when the South Bishop bears westward of South with a less depth than 40 fathoms, he will be near the end of that bank.

HATS.—The rocky foul ground, known as the Hats, is about one mile in extent within the depth of 10 fathoms; it has numerous shallow heads, over which there are heavy overfalls in bad weather, particularly with the weather tide. The shoalest spot is $1\frac{1}{4}$ fathoms, and is situated with Smalls lighthouse bearing W. by N. $\frac{1}{2}$ N., distant 2 miles; it breaks in bad weather, and, except at slack or high water, may generally be seen by tide rips.

BARRELS.—The foul ground known as the Barrels is about half a mile in length by the same in breadth. Near its north end is a rock which dries 10 feet at low water springs, with Smalls lighthouse bearing N.W. by W. $\frac{1}{2}$ W., distant $4\frac{1}{4}$ miles, and Grassholm

summit East, southerly, 3 miles. A patch of 2 fathoms lies one-third of a mile southward of it, and patches of 7 to 10 fathoms, foul ground, extend more than one mile northward of the dry head.

The Barrels are generally marked by tide rips, except near slack water ; in bad weather there is a heavy sea over them.

GRASSHOLM, a small island a little more than 6 miles from the west end of Skomar island, and nearly midway between it and the Smalls, is about three-quarters of a mile in circumference, and its rugged shores are scarcely approachable ; landing, however, may be effected in fine weather, the position depending on the wind and tide. This island, 146 feet in height, is a conspicuous object, being frequently the first land made when approaching from the south-westward.

Mersey rock lies nearly half a cable from the eastern end of Grassholm, and dries 2 feet ; off the west end of the island, at about the same distance, are several rocks, one of which dries 13 feet.

Grassholm race.—As the tidal streams set directly on to the island, they occasion a considerable race off both its ends, and a strong eddy or indraught on the opposite side to the tide, for the distance of upwards of a quarter of a mile from the rocks. The tongue of foul ground extending in a southerly direction from the island for upwards of one mile, with depths of 12 to 15 fathoms, and 23 to 26 fathoms close to on either side, causes overfalls.

Channels between the Smalls and Grassholm.—The two first mentioned of these channels, owing to the want of direct leading marks, and the strength of the tides through them, are not recommended to strangers, even in daytime with clear weather, and it is seldom that any advantage could be gained by using them.

That between the Smalls and the Hats is about $1\frac{1}{2}$ miles wide, and provided the Hats, or East rock at the Smalls, are seen by breakers, there is little danger. The leading mark is the South Bishop rock, three times its breadth open of St. David's head, bearing E.N.E. ; view A, on chart 1179.

The channel between the Hats and Barrels is 2 miles wide, and might be taken when these dangers are marked by breakers. The leading mark is Llaiethy peak (a conspicuous sugar-loaf* within St. David's head), in line with the Saddle (northern peak of Ramsay island), bearing E.N.E.

The channel between the Barrels and Grassholm, is, during day

* Penberry hill, a similar looking hill, eastward of Llaiethy hill, must not be mistaken for it.

light, almost as safe as that eastward of Grassholm. There are no dangers extending beyond half a cable from Grassholm, but to avoid the race which extends half a mile from it, the island should be passed at the distance of about one mile. Llaiethy peak open south-eastward of the south peak of Ramsay island, bearing N.E. by E. $\frac{1}{4}$ E., leads eastward of the Barrels.

At night, South Bishop light kept bearing northward of N.E. $\frac{1}{2}$ E., leads eastward of the Barrels, but it is not advisable to attempt this channel at night.

SKOKHAM ISLAND, nearly 2 miles from the mainland, is one mile in length east and west, half a mile in breadth, and attains a height near its western end of 165 feet; its sides are precipitous, terminating at its east extreme in a low neck, close off which is an isolated rock named the Stack.

Skokham has a rocky and barren appearance, with steep dark-coloured cliffs; a white farmhouse towards its eastern end is visible from the direction of Jack sound and from the south-eastward.

Skokham spit.—Sunken rock extend about 3 cables north-eastward of the Stack, known as Skokham spit, with deep water close-to. Isolated patches lie south-eastward of the Stack; the outer with 3 fathoms, and 11 fathoms close-to, lies S.S.E. $\frac{3}{4}$ E., distant $4\frac{1}{2}$ cables from it.

About midway along the north side of Skokham, and one cable from the shore, is a rock awash at low water.

On the south-eastern side of the island there is a bight, with 7 fathoms over a rocky bottom about one cable from the shore, where coasters sometimes anchor for a tide in fine weather; a half-tide rock, one cable from the shore, obstructs the south-western approach to it. In this bight, and in a nook near the Stack, are the only landing-places upon the island.

SKOMAR ISLAND, by its terminating the southern side of St. Bride's bay, becomes a very prominent feature of the Welsh coast, both from the northward and southward. The island is about $1\frac{1}{4}$ miles in length, by one mile in breadth, and surrounded by deeply indented precipitous cliffs, in places being nearly 200 feet in height; the main portion is nearly level throughout, but interspersed with small rocky peaks, the highest of which, 226 feet above the sea is marked by a flagstaff; the only farmhouse on the island lies close northward of it, and is only seen from certain directions. The island

is not very productive on account of its rocky nature and exposed situation. Rabbits are bred here for the London and other markets.

Anchorage—Landing.—There is a low isthmus nearly half a mile from its eastern end, where, at one time, it seemed probable that the sea would break through and thus form another detached mass similar to Mid isle: at present, however, the isthmus forms the common head of North and South havens, each of which affords occasional anchorage and a landing-place. In entering either of them, it is necessary to keep the western shore aboard, so as to avoid some out-lying and straggling rocks upon the opposite sides, and they must be quitted the instant the wind inclines inwards.

Mewstone.—Off the south point of Skomar is the conical green-capped islet named the Mewstone, of equal height with the island, and over-hanging singularly towards it. Off the northern extremity of Skomar there is also another high conical rock, the Garland stone, close to which, as well as round the outer or western part of the island, there is a depth of 20 fathoms over a rocky bottom.

Mid isle, which is 154 feet high, is only detached from Skomar by a pass 80 to 100 yards wide, with a least depth of 9 feet. Some rocks lie in mid-channel on the north side of the passage, which is only available for boats.

THE COAST.—**Wooltack point,** separated from Mid isle by Jack sound, which here has a breadth of 3 cables, is the west extreme of the peninsula separating St. Bride's bay from Milford haven. The point is dark, rugged, and about 150 feet in height; the peak within it, of the same name, is 175 feet in height.

From Wooltack point to St. Ann's head, entrance to Milford haven, distant about $4\frac{1}{2}$ miles, the coast is dark-coloured, indented with several bays, and precipitous in most places. Gateholm is the principal bay, but anchorage off this exposed coast should never be taken unless necessity compels, the bottom also is mostly foul.

A patch of $4\frac{1}{2}$ fathoms, with 8 to 10 fathoms around, lies 7 cables W.N.W. of Long point. The upper light at St. Ann's, bearing S.E. by S., leads south-westward of it.

Gateholm bay is skirted by sand one and half cable broad at low-water, with some scattered shelving rocks, and is bounded by perpendicular dark red cliffs, which are accessible only about mid-way and at their south-east end. Gateholm island projects one-third of a mile from the coast cliffs, and is also fringed by shelving rocks, which connect it at low-water with the main.

A detached rock dries one cable off the south-west end of the island, but the depth is not less than 7 fathoms at 2 cables off. Gateholm bay is a convenient anchorage for sailing coasters to wait a tide at, in northerly or off-shore winds, taking the precaution to anchor well out to prevent being embayed, should a shift of wind occur.

JACK SOUND.*—This passage, though little more than one cable in width, between the Horse on the mainland side, and Bitches rocks off Mid isle, is a very convenient one to coasters acquainted with it. When a stranger is informed of the sluicing and over-falling stream with its various and sudden eddies, which sets through the Sound at the rate of 5 or 6 knots, and that there is no decided mark for avoiding the dangerous outlying rocks, he will never willingly attempt it, but, from unavoidable circumstances, it may so happen that, coming from the south-eastward with a south-westerly wind and northern stream, and intending to pass through Broad sound, he may find his vessel, if a sailing craft, after passing Gateholm island, inevitably drawn into Jack sound stream. In such a case, as anchoring is out of the question, the directions must be carefully attended to.

The Benches form the first danger on the mainland side, when approaching Jack sound from the south-eastward. The outer part of these rocks, which never covers, is a quarter of a mile from the coast and upwards of three-quarters of a mile northward of Gateholm island; there is a depth of 2 fathoms between them and the reef fringing the coast, and 10 fathoms at one-quarter of a mile to the westward; but a rock, with $2\frac{3}{4}$ fathoms, lies $1\frac{1}{2}$ cables south-west from their outer extremity, and in the direct track to and from the Sound.

Inner Bench rocks, dry 12 feet at low-water springs, and lie three-quarters of a cable south of Anvil point, with sunken rocks half a cable to the westward.

Blackstones lie one-quarter of a mile southward of Mid isle, and N.W. $\frac{1}{3}$ W., half a mile nearly, from Bench rocks; they never cover, and are bold-to, except to the northward. East, distant 2 cables from Blackstones, is a small rock with $3\frac{1}{2}$ fathoms over it, also in the navigable Sound track.

Western Blackstone, a rock which dries 7 feet, with 5 to 8 fathoms around, lies three-quarters of a cable N.W. by W. $\frac{1}{2}$ W. from Blackstones; one cable N.E. $\frac{1}{4}$ E. from Western Blackstone is a rocky patch of 2 fathoms.

* See plan of Jack sound, on Admiralty chart, No. 1,488.

Horse rock, which dries 8 feet, lies about one cable off the mainland, northward of Anvil point. Nearly midway between it and Inner Bench rocks, are two other rocks; the innermost dries 12 feet at low-water springs.

The Bitches dry 16 to 18 feet at low water, and shelve from Mid isle towards the Horse, leaving a clear passage only 260 yards wide. Some dangerous sunken rocks on the channel side of the Bitches must be guarded against.

Tucker rock, off Wooltack point, about 5 feet above high water, and black, with a sunken rock half a cable southward of it, though bold-to on the outside, must be approached with caution, as a strong eddy sets round it, with a considerable overfall.

In the narrowest part of Jack sound a depth of 6 and 7 fathoms will be found, but the lead will fall into a depth of over 20 fathoms just northward of the Tucker.

Tides.—In Jack sound, the stream sets to the northward from $2\frac{1}{2}$ hours before low water, to $3\frac{1}{2}$ hours before high water at Liverpool; the southern stream the reverse. The northern stream sets directly across for Ramsey island with great strength for a short distance; the southern sets nearly direct through Jack sound, but causes a dangerous eddy near the south side of Mid isle, which should be carefully avoided, if working through with southerly winds.

Directions.—As before stated, Jack sound should only be used by seamen with local knowledge. Should the tide be adverse, (at which time it could only be used with a strong fair wind, or by steam vessels), be careful of the helm, for the rate of the stream is such that a broad yaw would sheer the vessel in a moment, either upon Horse rock or upon the Bitches, to her certain loss.

Coming from the southward, pass close eastward of the Blackstones, and having passed them, steer towards Tucker rock, with the western extreme of Skokham island just open eastward of the eastern part of Blackstones, bearing S.W. $\frac{1}{4}$ W.; this leads between the Horse and the Bitches; when the Garland stone opens northward of Mid isle, the vessel will be northward of the Bitches, and course should be shaped more to the northward.

BROAD SOUND, the wide and available channel formed between Skomar and the mainland to the northward, and Skokham to the southward, has over the greater portion of it depths varying between 15 and 25 fathoms, but it is partially obstructed by the Knollbank and Wildgoose race.

The Knoll, within a depth of 10 fathoms, is one mile in length by a quarter of a mile in breadth, and situated nearly midway between Skomar and Skokham. Within a depth of 5 fathoms it is 2 cables in length, but on it are several rocks with only $3\frac{1}{2}$ and 4 fathoms upon them; its eastern extreme lies with the Stack at Skokham bearing S.E. by S. distant $1\frac{1}{10}$ miles.

The sandy portion of this bank affords a convenient stopping-place for coasters, in light winds, when the tide is adverse to them. Here the streams are variable and much slacker than in other parts of Broad sound.

Wildgoose race.—An overwhelming sea for small vessels breaks off Skokham and Skomar, with a weather-going tide and strong winds; and with a westerly wind and northerly stream, broken water, known as Wildgoose race, sweeps outwards between the western extremities of these islands. Small craft have been known to founder in it, and others have been dismasted from the stress occasioned by its high cross sea.

Rocky patches with $4\frac{3}{4}$ and 5 fathoms over them exist in that portion of the race westward of Skokham, with the west-end of that island bearing S.E. $\frac{1}{2}$ E. about 6 cables.

Depths.—Tidal streams.—The depths from St. Ann's head to Jack sound at half a mile off-shore are 11 and 12 fathoms over coarse ground, but they deepen to between 16 and 25 fathoms in the fairway of Broad sound. At 2 miles off Milford Haven entrance, and one-third of a mile outside Skokham and Skomar, the depths (excepting over the rocks in Wildgoose race) are about 27 fathoms, with sand and shells off the Haven, and rocky bottom off the islands. At this offing, the northerly stream runs from $1\frac{1}{2}$ hours before low water till $1\frac{1}{2}$ hours before high water at Liverpool, and the ebb stream in an opposite direction; inshore, they make half an hour later. On the Knoll, the direction of the stream is constantly varying, and is much slacker in its rate than elsewhere in the sound.

Directions.—In passing through Broad sound in moderate weather it is necessary for deep draught vessels to keep on the Skomar side of the passage, so as to avoid the rocky patches upon the Knoll. To clear them, keep the south-east end of the sand in Gateholm bay, just open of Gateholm island, S.E. by E. $\frac{1}{2}$ E., until Skokham Stack bears S. by W. $\frac{3}{4}$ W., when steer S.S.E., allowing for tide, about one mile outside St. Ann's head.

DIRECTIONS for approaching Milford Haven.—Approaching Milford Haven from the westward the set of the

tidal stream is one of the most important points to be considered when approaching the Smalls and the dangers eastward of it. Northward of about lat. 51° N., between the Tuskar and the Smalls, the stream will always be found running northwards towards the entrance to Liverpool whilst the water is rising there, and southward whilst falling ; the latter sweeping round the Smalls south-eastward into the Bristol channel as previously described (pp. 14, 84). From the southwestward, St. Ann's head, with its powerful lights, would be made for direct ; but from the south or east coasts of Ireland, it is advisable to make direct for the Smalls light or Grassholm island. The route either northward or southward of these may be taken, according to circumstances ; if northward, pass between Grassholm and Skomar, which channel is 6 miles wide, with a true tide of 2 to 4 knots, or within a mile westward of Grassholm (p. 86) ; the channels between the Barrels and the Smalls should only be used by those acquainted with them ; they offer no advantages to steam vessels, and moreover are dangerous.

Although there are no dangers beyond half a mile from the Smalls lighthouse, it is advisable to give it a berth of at least 2 miles on account of the strong tides and the dangers eastward of it. This distance is readily checked by four-point bearing. Thence, if passing southward of it, course may be shaped direct for St. Ann's, observing, if the weather be clear, that Dale valley, only just open, or touching the north extreme of Skokham island, leads one mile southward of the Barrels, and a greater distance from the Hats. (Sketch D on chart 1179.)

If passing northward of the Smalls, the whole of Skomar island must be kept open northward of Grassholm. (Sketch C on chart 1179, also on No. 1188.) Pass northward and eastward of Grassholm at about the distance of one mile, and south-westward of Skokham at the distance of 2 miles, to avoid the tide races off them, thence shape course one mile southward of St. Ann's head. Directions for entering the Haven, *see* p. 104.

At night.—Having rounded the Smalls as above, keep out of the *red* ray of light shown from the Smalls, over the Hats and Barrels, until abreast Grassholm, or the South Bishop light is in line with it, thence there are no dangers worth specially mentioning. St. Ann's upper light is visible from abreast the Smalls in clear weather as well as that of the South Bishop.

Sailing vessels, with the northern stream running, should endeavour to pass well southward of the Smalls, else without a strong

and favourable wind they might possibly be swept northwards of Skokham. With the southerly stream, they should pass well northward of the Smalls and Grassholm, and northward or southward of Skokham, according to circumstances. If proceeding northward of Skokham (which is the recommended route when the southern stream is running, particularly if the wind be scant), pass within half a mile of Skomar to avoid the Knoll; the south end of the sand in Gateholm bay, just open of Gateholm island, leads midway between it and Skomar; when the Skokham stack bears S. by W. $\frac{3}{4}$ W., steer S.S.E., allowing for tide, for St. Ann's, as given on page 104.

ST. ANN'S HEAD, the western point of the entrance to Milford Haven, is a bold promontory about 120 feet in height, projecting from a comparatively flat background; its dark rocky cliffs are deeply indented, the largest of which is known as the Cobblers' hole. The head, with its white lighthouses and keepers' dwellings, telegraph and fog siren towers, are seen from a considerable distance in clear weather, and are easily identified.

LIGHTS.—From the low lighthouse, 42 feet in height, painted white, erected near the edge of the cliff, is exhibited, at an elevation of 159 feet above high water, a *fixed white* light, visible in clear weather from the direction of Skomar island all round seaward from a distance of 18 miles, except where intercepted by Skokham island.

From the high lighthouse, 75 feet in height, also painted white, and situated N.N.W. 203 yards from the low lighthouse, is exhibited, at an elevation of 192 feet above high water, a *fixed white* light, visible seaward (where not intercepted by land) from a distance of 20 miles. The lights in line lead between Turbot bank and the Crow and Toes rocks.

A *red* sector of light is shown from the high lighthouse over Chapel and Thorn rocks, between the bearings of N.W. and West. See lights in the Haven, p. 100.

Fog signal.—A powerful fog siren is sounded in thick or foggy weather, *giving one blast every three minutes*.

Signal and telegraph.—Near the lighthouses, on St. Ann's head, is a telegraph and signal station, connected to H.M. dockyard and the post-offices. See Dockyard signal station, p. 109.

Coastguard and lifeboat stations.—There is a coastguard station at St. Ann's head, and a lifeboat and coastguard station at Angle point, nearly 4 miles eastward of St. Ann's.

MILFORD HAVEN*—Capabilities.—Milford Haven is one of the finest harbours in the United Kingdom. It offers the only perfect and accessible shelter from all winds at all times, and for all classes of vessels, between Falmouth and Holyhead. From St. Ann's head, at the entrance, to H.M. dockyard near its head, it is 9 miles in length, varying from $1\frac{1}{2}$ miles in width at the entrance to half a mile in places above, with good anchorage throughout. The depth on the leading mark through the entrance is from 8 to 9 fathoms at low water, deepening to 11 or 12 fathoms between the Stack fort and Milford; there is nowhere less than 6 fathoms, between the entrance and the anchorage close westward of the dockyard.

When the tide is out, the navigable water, beyond the 3-fathom limit, is contracted by flats or shelves of mud to about half a mile in width at Stack rock, decreasing to $1\frac{1}{2}$ cables abreast of Weare point; between the Weare and Carr rock it widens to $2\frac{1}{2}$ cables, then again contracts to nearly $1\frac{1}{2}$ cables at Carr spit. Pembroke reach, above Carr spit, contains a central danger named Dockyard bank. The greatest depth in the Haven is 14 fathoms, a little within Stack rock, and the bottom generally is composed of mud, with some sand and shells about the entrance, and oyster beds, which latter are chiefly above Weare point.

Above the dockyard the Haven merges into the Cleddau river, in which there is a depth of about 5 fathoms for 3 miles, thence it becomes narrow and barred in places; but small steam craft, at high water, can reach Haverford West, about 13 miles above the dockyard. The entrance to the Haven is open to the south-westward, but within Thorn fort it trends east-south-eastward.

The Haven is not sufficiently lighted for safe night navigation much eastward of the Stack, except with local knowledge, but secure anchorage is easily reached, either in Dale road or abreast Stack fort. Milford, and even the anchorage westward of the dockyard, may possibly be reached by moderate draughts when the weather is clear, but the night navigation is not recommended except for light draughts.

Aspect.—The shores of the Haven are chiefly formed of bold cliffs of a moderate height. The most prominent features, commencing from within St. Ann's, are the following :—

The East and West Blockhouse points : upon the first is a small ruin, and close off it a detached rock named Rat island, and on

* See Admiralty plan of Milford haven and Pembroke reach, No. 2,393, scale $m = 3\cdot5$ inches; Chart of Bristol channel to New Quay, No. 1410; Bristol channel, No. 1,179; and Irish channel, No. 1825*b*.

the latter point is constructed a battery. Then Thorn island on the east, and directly opposite is Dale point, on both of which are powerful batteries. Between Dale and South-hook points there are three considerable indentations, formed by the intermediate heads of Watch-house and Great Castle, the latter indicated by its light towers and light-keepers' whitewashed dwellings. Both on South-hook point and the off-lying Stack rock, batteries again command the approaches, which are still further protected by the forts on Hubberston and Popton points respectively, on the north and south shores.

Westward of Popton point is the bay and village of Angle. At 5 miles within the entrance on the north side of the haven, and situated between the pills or creeks of Hubberston and Castle, is the town of Milford; at this point is situated the new dock described on page 108; the church, with its tower elevated 205 feet, is a conspicuous object. At three-quarters of a mile above, projecting from Newton Noyes, is an iron pile coaling pier, having at its extremity a depth of 15 feet at low water, and connected with the docks and branch railway which joins the Great Western main line at Johnston station. About one mile above the pier is Weare point, where the turn of the channel trends with the curve of the point; and directly opposite, between two bluff heads, is the entrance to Pennar mouth, within which, about $2\frac{1}{2}$ miles up, terminates at Pembroke, the extensive ruins of its castle dividing the creek into two short arms.

One mile above Weare point, on the south side at Pembroke dock, is the government establishment, including an extensive dockyard which in 1814 was transferred from Milford. In Treowen fort, on the rising ground behind the dockyard, the artillery are quartered, the infantry being stationed in the hut barracks within Hobbs point. On Hobbs point is a flagstaff, and lofty sheers painted in red and white horizontal bands, which are serviceable as a leading mark up the haven.

Opposite to Hobbs point is Neyland or New Milford, the terminus of the Great Western railway, which is connected with a pontoon pier south-east of it, with depths of 14 feet alongside at low water.

DANGERS IN THE APPROACH, and in the Haven.—

Off the several points on either side of the entrance, the connected low-water rocks do not extend beyond three-quarters of a cable, but the foul ground off St. Ann's, and the Middle ground and other shoals, produce, especially at the junction of the ebb from the haven and the stream outside it, when opposed to westerly gales, so heavy a sea,

breaking at times nearly across the mouth, as to render its navigation somewhat dangerous for sailing vessels.

Turbot bank derives importance from its lying near the fairway to the haven. Its centre and least water, $5\frac{1}{4}$ fathoms, is situated $3\frac{1}{4}$ miles, South, nearly, from St. Ann's lower light.

Within the depth of 10 fathoms, the bank is $1\frac{1}{2}$ miles in length in a north-west and south-east direction, by half a mile in breadth. Within a depth of 6 fathoms it is 7 cables in length.

The stream of tide sets somewhat obliquely across the bank, and in bad weather it should be avoided on account of the short and dangerous sea there; in fine weather, however, it affords a convenient anchorage for coasters when the wind is light and the stream adverse.

Clearing marks.—Skomar island touching Skokham leads seaward of Turbot bank; St. Ann's lights in line, or Saddle head only just open of Flimstone head leads within it. Thorn island in line with, or open of Rat island leads westward, and Rat island in line with, or shut in with west end of Sheep island, leads eastward of Turbot bank.

St. Ann's head shoals extend south-westward nearly half a mile from the head, with depths from 3 to 5 fathoms over broken ground; a patch of 3 fathoms lies 4 cables W.S.W. of the lower light, and a patch of $4\frac{1}{4}$ fathoms, lies 5 cables S.S.W. $\frac{1}{2}$ W. from the light; this latter danger is only 2 cables westward of the leading mark, Castle head lights in line.

In Mill bay, north-eastward of St. Ann's head, foul ground extends some distance off shore; the outer patch of $2\frac{1}{4}$ fathoms lies a quarter of a mile S.W. of West Blackstone point flagstaff.

Rows rocks divide the entrance of the haven into two channels, the western of which is usually taken.

These rocks occupy a space rather more than one mile in length, in the direction of the channel, the shoalest water being at the extremes.

Middle channel rocks form the south-west portion of Rows rocks, and within a depth of 5 fathoms, are $3\frac{1}{2}$ cables in extent. The shoalest spot, near the centre, is 19 feet, and lies with St. Ann's lower light bearing N. by W. $\frac{3}{4}$ W. distant $7\frac{1}{2}$ cables, and with the high light just open northward of the low light. Patches of foul ground, $4\frac{1}{2}$ to 5 fathoms, lie between Middle channel and Chapel rocks.

Buoy.—A red conical buoy, surmounted by a staff and diamond, lies in 7 fathoms, about one cable westward of the 19-foot patch on Middle channel rocks, with St. Ann's lower light bearing N. $\frac{3}{4}$ W. distant $6\frac{1}{4}$ cables.

Chapel rocks form the north-east extreme of Rows rocks, and cover a space of about 3 cables in extent; its shoalest spot is 2 fathoms, on its eastern side, with St. Ann's lower light bearing W.N.W. distant $1\frac{1}{4}$ miles.

Buoys.—A red conical buoy in $7\frac{1}{2}$ fathoms (about 50 yards north-eastward of a 4-fathom patch) marks the north-west side of Chapel rocks, with St. Ann's lower light bearing W. by N. $\frac{1}{4}$ N. distant $11\frac{1}{2}$ cables.

A can buoy, red and white vertically striped, in $5\frac{1}{2}$ fathoms, marks the south-east side of Chapel rocks, with centre of Rat island E. $\frac{1}{4}$ S. distant $4\frac{1}{2}$ cables.

Sheep rock, with a least depth of $3\frac{1}{2}$ fathoms, lies in the fairway of the eastern channel, with the west extreme of Sheep island bearing E. $\frac{1}{4}$ N. distant 5 cables. Several isolated patches of $4\frac{1}{2}$ to 5 fathoms lie about a quarter of a mile southward of Sheep island.

A patch of $1\frac{1}{2}$ fathoms lies $1\frac{1}{2}$ cables S.W. by W. $\frac{1}{2}$ W. from Rat island, east side of eastern channel; the two last mentioned shoals are unmarked.

Thorn rock, one cable in extent, with a least depth of 9 feet on its northern extreme, lies one-third of a mile S.W. by W. $\frac{3}{4}$ W. from Thorn island fort. A rocky ledge, dry at low water, extends about 250 yards westward of the island, with shallow water beyond it. The passage between the island and the main, one cable wide, has about 10 feet at low water.

Buoy.—A red conical buoy in 5 fathoms, lies half a cable westward of Thorn rock, with Thorn fort flagstaff bearing E.S.E. distant about 4 cables.

Off Great Castle head, on the north shore of the haven, abreast Thorn island, the ground is foul, and at the distance of 2 cables lies a detached rock with 9 feet water.

Stack rock.—On Stack rock is a powerful fort, as before mentioned. It is situated about one cable within the 3-fathom contour extending from South Hook point, and 3 cables from the point. A ledge partly dry at low water extends about one cable eastward of the fort.

South-eastward of South Hook fort, foul ground extends to near the 3-fathom edge, having 10 feet water only, at $3\frac{1}{2}$ cables from the shore. Between Stack rock and Milford the 3-fathom edge of the bank is not less than $2\frac{1}{2}$ cables from the shore.

Shelves.—In the long and nearly straight reach up the haven, from Thorn point to Weare point, there is no obstruction outside the 3-fathom line. There are no rocks beyond three-quarters of a cable from the high water line.

Angle and Milford shelves.—Angle bay dries out to a little beyond its entrance points at low water ; and the bight at Milford, between Hakim and Newton Noyes points, also dries, except in the dredged passage to the dock. Off both shores of the haven, shelves of sand and mud slope out gradually, with a well defined edge of 3 fathoms ; Angle shelf on the south side, between Thorn island and Popton point, has an extreme breadth of one-third of a mile abreast Angle bay ; and the shelf opposite, from Stack rock to Newton Noyes, has an average breadth of about 4 cables.

Pwllcrochan flats, between Popton and west Pennar points, dry out in a convex form towards the northern shore of the haven, the extreme edge, which is steep-to, being about 4 cables off Martins haven point ; the channel between it and Newton Noyes pier is little more than 2 cables in breadth.

Weare tongue.—The low-water projection of Weare point, composed of shingle and mud, dries out in a S.E. by E. direction towards the dockyard for a quarter of a mile, with a 2-fathom spit extending about three-quarters of a cable outside it towards Pennar mouth. From the extremity of the spit, Hubberston observatory is in line with the coast eastward of Newton Noyes pier.

Buoy.—A can buoy, chequered black and white, in about 3 fathoms, marks the south edge of the spit, with Newton Weare cottage bearing N. by E. distant $2\frac{1}{2}$ cables.

Pennar flats, composed of mud, and separated from Pwllcrochan flats by the gut which leads into Pennar mouth, dry off to the distance of $2\frac{1}{2}$ cables between Pennar point and the Carr rocks ; the 3-fathom edge is from a half to 2 cables beyond it.

A patch of $2\frac{3}{4}$ fathoms, just within the 5-fathom edge, with 8 fathoms a short distance outside it, lies $1\frac{1}{2}$ cables off the dry edge of Pennar flat, and nearly midway between Weare point and mount Pleasant, with the dockyard outer red light bearing S.E. by E. $\frac{1}{4}$ E distant $5\frac{1}{2}$ cables.

Carr rocks and spit.—A ledge of rocks, named the Carr, project $2\frac{1}{2}$ cables N.W. by N. from the north-west extreme of the dockyard; the highest rock, situated about midway, dries 10 feet at low water springs; within this high rock is a swashway available for small craft acquainted with it.

Carr spit extends 2 cables beyond the high Carr rock, its 3-fathom edge being $3\frac{1}{2}$ cables north-westward of the near corner of the dockyard.

Buoys.—The north-west extreme of Carr spit is marked by a conical black buoy (No. 1), with staff and globe, in 4 fathoms water, with north-west extreme of dockyard bearing S.S.E. $\frac{3}{4}$ E. distant $3\frac{1}{2}$ cables. A black conical buoy (No. 2) marks the north-east extreme of the spit, in about 4 fathoms, and $1\frac{1}{2}$ cables E. by S. $\frac{1}{2}$ S. of the north-west buoy.

Dockyard bank, eastward of Carr spit, and separated from it by a swashway, occupies the middle of Pembroke reach abreast the dockyard. Within the 3-fathom line it is 3 cables in length by $1\frac{1}{2}$ cables in breadth, and consists of gravel, mud and shells; the greater portion of the bank has depths of 6 to 9 feet only at low water.

Buoys.—The north-west side of Dockyard bank is marked by a conical black buoy (No. 3), in about 4 fathoms water, placed about half a cable north-eastward of its west extreme, with the north-west point of dockyard bearing S. by W. $\frac{1}{2}$ W., distant $2\frac{1}{2}$ cables.

A conical black buoy (No. 4) is also placed off the east end of Dockyard bank, in 5 fathoms, with north-west extreme of dockyard bearing W. by S., distant $3\frac{1}{4}$ cables. A small patch of 4 fathoms lies near the edge of the 5-fathoms line, about 80 yards south-eastward of this buoy.

Prince Consort rock, a pinnacle with 19 feet least water, lies near the centre of the anchorage between Dockyard bank and the dockyard, with the outer extreme of western landing bearing S.S.W. $\frac{3}{4}$ W., distant nearly one cable.

The Swashway between Carr spit and Dockyard bank, has 19 feet at low water springs, with the dock chimney in line with the third top window from the north end of the building shed eastward of it, bearing S. by E.

Shore flats—The dockyard is bordered by a shelf of mud, to the distance of 60 yards at low-water springs, or close out to the end of the landing slips; thence the low line trends straight to Hobbs

point, the whole of the deep bight between, known as West Lanion pill, being dry at low water; small coasters lie here aground on the mud.

On the north side of Pembroke reach the mud flat, interspersed with stones, dries off from one to two cables at low-water springs.

Buoy.—A can buoy, chequered black and white, in 2 fathoms, marks the edge of the flat off Neyland point, with the end of the landing pier bearing N. E. by E. $\frac{3}{4}$ E., distant $1\frac{1}{2}$ cables. A beacon, with staff and ball, lies on the mud flat within the buoy (for local purposes).

The end of the Neyland landing pier is marked by a boat showing a *fixed white* light at night, and the pontoon pier is lighted by gas lamps. The shore within is chiefly composed of shingle with some patches of large stones. A shallow projection extends $1\frac{3}{4}$ cables from Neyland point, marked by a black can buoy in 12 feet at low water.

LIGHTS.—**Great Castle head.**—From the white square tower, with vertical black stripe, erected on Great Castle head, is exhibited a *fixed white* light at an elevation of 112 feet, which is visible from a distance of 16 miles.

A *fixed white* light is also exhibited from the white turret with black stripe, on the keeper's cottage, seaward of the former, at an elevation of 76 feet, visible 14 miles. The two lights are 174 yards apart, and when in line bearing N.E. by E. $\frac{1}{4}$ E.. lead in the channel of deepest water between St. Anns head and the rocks eastward of it. For St. Ann's lights, *see* p. 93.

Milford reach.—A *fixed red* light is shown from the western pier head at the entrance to Milford docks, a similar light from the west side of entrance to Castle Pill, and a third *fixed red* light from the end of the pier at Newton Noyes. Two *green* lights, vertical, are shown from the east side of Milford dock entrance when the gates are open.

Pembroke reach.—From the Dockyard, two *fixed red* lights are exhibited. The high light, from a building 1,130 feet within the western boundary wall, is elevated 46 feet, and visible between the bearings E. by S. $\frac{3}{4}$ S. and S.E. $\frac{1}{4}$ S. The low light, placed on the west boundary wall, is 23 feet high, and visible between the bearings E. by S. $\frac{1}{2}$ S. and S.S.W.; except a *green* sector which marks the direction of Carr spit, from S. $\frac{1}{4}$ E. to S. by E. $\frac{1}{4}$ E.

The Great Western Railway Company, for the convenience of their steamers, have placed on the north shore of Pembroke reach, four small

fixed white lights, viz.: at Church lake, near Neyland, two *fixed white* lights 176 yards apart, in huts painted white, with vertical red stripe, which, when in line E. by N. $\frac{1}{4}$ N., lead clear of the shoal ground extending off Weare point and also of Carr rock. And at Hazel beach two *fixed white* lights, placed 153 yards apart, which kept in line bearing N.W. by W. $\frac{1}{2}$ W., lead from their intersection with the Church lake leading lights in line, southward of the two mooring buoys on the north side of Dockyard bank, and clear of Neyland spit.

These four lights are not exhibited on Sunday nights, and it should be observed that the Hazel beach lights in line lead over the north-east edge of Dockyard bank in 13 feet at low water.

A small *fixed white* light is also exhibited from a boat moored close off the Neyland landing slip; the steamer pontoon is lighted by gas lamps, as before stated.

Pilots and Steam-tug.—Licensed pilots for Milford haven, of whom there are seven, reside at Angle, Milford, Hakin, and Pembroke dock; when practicable a boat is generally cruising about the entrance of the haven.

The Queen's Harbour Master takes charge of the pilotage of H.M. ships above Weare point.

A steam-tug is stationed at Milford for general service, and vessels approaching the haven with a signal for assistance, will have their communication sent on to Milford by telegram from St. Ann's head.

Tides.—It is high water, full and change, at St. Ann's head at 5h. 56m. local time, or 6h. 16m. Greenwich; springs rise 24 feet, and neaps 18 feet.

At Pembroke dock 6h. 12m. local, or 6h. 32m. Greenwich time; springs rise $22\frac{1}{2}$ feet, and neaps $17\frac{1}{2}$ feet.

The stream off St. Ann's head begins to run to the north-westward at about 3 hours flood on the shore, or 2 hours before low water at entrance to Liverpool, and runs until 3 hours ebb by the shore, or until 2 hours before high water at the entrance to Liverpool, when it turns to the south-eastward for 6 hours; velocity from $2\frac{1}{2}$ to 2 knots. Off the Dockyard and in the reach below, the tide runs from 2 to 3 knots at springs, the ebb being accelerated by heavy river freshes; the stream in the Haven turns at about high and low water by the shore.

ANCHORAGES.—The anchorages for large vessels are first considered.

Milford road.—From about one mile eastward of the Stack fort to Newton Noyes pier a little above Milford, a distance of about 2 miles, good shelter and holding ground will be found for any class of vessel, under ordinary circumstances, in from 8 to 12 fathoms, over a bottom composed chiefly of mud; the breadth off Milford between the 2 fathom lines being about 3 cables. Abreast the town a good position, in about 10 fathoms, is with Dale castle open northward of Stack fort, about twice the breadth of the fort, bearing W.N.W., and St. Catherine's church N.N.E. Large vessels should moor across the stream to avoid the risk of tailing on the flats at low water when swinging. It is also desirable for small vessels to have two anchors down with open hawse seaward, as the length of the reach admits the rising of a short and trying sea, obliging them at times to slip and seek shelter off or above the dockyard. All vessels will ride athwart the wind, however hard it may blow, during the strength of the tide.

Pembroke reach lies above Weare point and off the dockyard; it is about three-quarters of a mile in length, but much obstructed by shallow banks, rendering the taking in of moorings necessary. A set of Government moorings for a heavy draught ship lies in 7 fathoms, between Weare point and the west end of the dockyard; there are also several sets off the dockyard and in the reach above it for smaller vessels.

H.M. ships are taken in pilotage charge at Weare point by the Queen's Harbour Master, who boards the vessel there and takes her to her mooring buoy, as stated on p. 101.

Hobbs point.—One deep draught vessel can be berthed at Hobbs point, under the sheers, about 50 feet distant, where there is from 24 to 30 feet water; close to the wharf are some projecting boulders; here the vessels built at H.M. dockyard receive their boilers and parts of their machinery.

The Great Western Railway pontoon on the opposite or Neyland side, has from 12 to 14 feet water alongside at low water.

Anchorage for light draught vessels and coasters.—**Dale road.**—There is fair anchorage for light draught vessels in Dale road, situated about $1\frac{1}{2}$ miles within the entrance to the haven, during northerly and westerly winds. A good berth is under Dale point in not less than 15 feet, with Sheep island open. The seaweed so profusely covers the bottom as often to prevent light anchors gripping. It would be only of use to a sailing craft waiting for tide.

In **Sandy haven bay**, northward of Stack rock, when it is not being used for torpedo experiments, small vessels during northerly

winds may lie snugly in about 3 fathoms over a sandy bottom, by bringing Dale castle in line with Great castle head, and East Blockhouse point seen through Thorn sound. At spring tides small craft may get into the creek at the head of the bay, and lie aground.

The shallow patches extending 2 cables off Castle head, the rock with less than 6 feet 2 cables southward of Little Castle head, and the 9 feet patch 2 cables eastward of the last-mentioned rock, both just within the 3-fathom line, must be avoided.

Torpedo ground.—In Sandy Haven bay a conical buoy, painted green and white in horizontal bands, and marked *Torpedo mooring ground*, is temporarily placed in $4\frac{1}{4}$ fathoms water, in a line about midway between Great Castle head and Stack rock, to mark the south-western limit within which torpedo experiments are made. The buoy is removed when the annual operations are over.

Whilst the buoy is in position mariners are warned not to anchor or pass inshore of the lines joining Great Castle head lighthouse to Stack rock fort, and thence to the east extreme of South Hook fort. Small vessels bound to or from Sandy Haven pill may pass within the Torpedo ground, but should keep on the western shore of Sandy Haven bay, avoiding the dangerous rocks above mentioned.

Angle bay, situated on the southern shore between Angle and Sawdern points, and about $1\frac{1}{4}$ miles eastward of Thorn island, is nearly three-quarters of a mile deep, but at low water a mud flat dries out beyond the points. There is, however, a general depth over it of 19 to 20 feet at high water ordinary springs, and it offers shelter and complete safety to wind-bound coasters, and to those arriving without anchors; the only obstruction on entering being a patch of flat rocks within the low-water mark, a quarter of a mile from Angle point.

Rhoshcrowther and Angle churches and villages lie respectively near the south-eastern and north-western bights of Angle bay; the latter bight is to be preferred for shelter in westerly winds.

There is a coastguard and lifeboat station in Angle bay, as mentioned on page 93.

Pennar mouth, the entrance to which is situated about one mile westward of the dockyard, is nearly all dry at low water; the gut, between the flats and shelving rocks of Pennar points, is less than half a cable wide, with about 10 feet water, but there is not more than 3 feet at low water over the bar leading to it, between Pwllcrochan and Pennar flats; just within the points is Crow pool, where, and upon the surrounding mud, small vessels will find a safe resort.

On the east side of the entrance are two small piers; the outer has a depth of about 8 feet and the inner 2 feet, at low-water springs.

Jacob's pill.—At about $1\frac{1}{2}$ miles up Pennar mouth, at Jacob's pill on the north shore, are the Milford Haven shipbuilding works, where several foreign ships of war have been built, and large repairs to machinery undertaken. The works have been closed since 1887.

Pembroke quay.—At high water springs vessels of 12 feet draught can proceed up to Pembroke town quay, under the walls of the old castle at Pembroke, where there is a depth of 13 feet; at neaps there is about 8 feet. There is but little trade here.

In the haven above Pennar mouth, coasters with ordinary precaution may drop anchor in such places which afford the necessary water, as south-westward of Carr spit; between Llanstadwell or Church-lake flats and the Dockyard bank; off west Lanion pill, or lie aground on the flats of the Pill as is the custom with coasting craft trading to Pembroke dock; above Neyland there is good anchorage almost anywhere in the river.

DIRECTIONS*.—Milford haven may be entered with great facility during daylight and clear weather, for the position of its entrance is well marked by the white lighthouses and other buildings on St. Ann's head, and the several obstructions are guarded by buoys. Precelly mountain, 1,750 feet high, and situated about 22 miles inland, will be seen in clear weather from a considerable distance, and when bearing N.E. by E. $\frac{1}{2}$ E. will lead direct to the entrance. From the south-eastward, the coastguard station on Linney head is conspicuous.

The channel between St. Ann's head and the Middle ground, is wider, deeper, and less obstructed by foul ground than that eastward of the Middle ground; it is also better marked, and can be used at night, and therefore is invariably used by vessels entering or leaving the Haven.

From the westward (*see* pp. 91, 92) steer to pass about one mile or more southward of St. Ann's head, observing that Skomar island touching Skokham island leads a good mile southward of the foul ground off St. Ann's; and when Stack fort is only just open northward of Thorn island fort, bearing E. by N., steer for it, until Castle head lighthouses are in line, bearing N.E. by E. $\frac{1}{4}$ E.; these kept in line lead through the fairway of the western channel to abreast Thorn island.

From the south-eastward, Skomar island touching Skokham will lead outside Turbot bank, over which there is a heavy sea in bad weather; when Castle head lights are in line, steer for them as before.

* For approaching the Haven, *see* pp. 91 and 92.

In thick weather, a stranger should be careful to preserve a good offing, unless the fog signal at St. Ann's head is heard, when he must act according to circumstances.

Proceed with Great Castle head lights in line, until the coastguard houses at St. Ann's are just shut in with West Blockhouse point, or the point eastward of Popton fort is opening northward of Thorn fort, then steer E. $\frac{1}{4}$ S. for Stack fort, passing northward of Thorn rock buoy, until Thorn fort bears South, distant $2\frac{3}{4}$ cables. Here, in clear weather, the sheers at Hobbs point, painted with red and white bands to render them conspicuous, will be seen a little open of Weare point, bearing E. by S. $\frac{3}{4}$ S.; this mark, as seen from this position (sheers about half a degree open of the point) should be steered for, until nearly abreast Hubberston fort, or Sawdern point, when the sheers should be brought on with Weare point; from abreast Hakin, the western part of Milford, the sheers should be brought a little in over Weare point, to avoid Pwllcrochan flats.

If this distant mark be obscured by haze, proceed on the course E. by S. $\frac{3}{4}$ S.,* midway between Stack and Thorn forts, until the west extreme of South-hook fort opens eastward of Stack rock, when alter course for the north extreme of Popton point until West Blockhouse battery is in line with the north extreme of Thorn island bearing W. by N., which mark kept on, astern, will lead in the fairway to abreast Milford, where anchorage may be taken in 10 fathoms when St. Catherine's church bears N.N.E. (as stated on page 102), or where most convenient.

If shelter only is sought, anchorage may be taken up lower down, anywhere abreast Angle bay, with West Blockhouse point battery open to the northward of Thorn island, in a depth of from 6 to 12 fathoms at low water. No vessel under such circumstances should anchor below Stack rock, for there the ground is bad and the sea heavier.

When proceeding to Pembroke reach, keep the sheers at Hobbs point in over Weare point bearing E. by S. $\frac{7}{8}$ S., until the south chimney of Albion house comes on with the Gun tower at west end of Dockyard bearing S.E. by E. $\frac{1}{4}$ E., which leads northward of Pwllcrochan flats, and southward of Weare point buoy in about 4 fathoms water; a deep-draught vessel, when Pennar west point bears S. by E., should open the whole of Albion house southward of the Gun tower to avoid the shallow water off Weare point, passing half a cable or more southward of the buoy; thence steer to pass close to on

* The bearing of Weare point is of little use at this distance.

either side of the black mooring buoy, northward of Carr spit and Dockyard bank buoys, and southward of Neyland point buoy if proceeding higher up, but the channel is not buoyed above Neyland spit.

H.M. ships are taken in pilotage charge by the Queen's harbour master at Weare point, as before stated.

If proceeding to the mooring buoys close off the Dockyard, the Swashway between Carr rocks and Dockyard bank is sometimes used. It has a depth of 19 feet at low water, over a breadth of about 50 yards, at which time it would be seldom used. The leading mark (view A on plan of Pembroke reach) is the dock chimney in line with the third window from the north end in the top row of the building shed east of it. The mooring buoys southward of Dockyard bank lie in the fairway. Vessels must not anchor except on an emergency, the ground being crossed by many mooring chains.

From Hobbs point the river is navigable for small vessels at high water to Haverfordwest, but for this part of the navigation and other arms or creeks of the estuary, the services of a local pilot are necessary. For description, *see* pp. 110, 111.

By Night.—From a distance of about two miles outside St. Ann's head, bring the lights on Great Castle head in line bearing N.E. by E. $\frac{1}{4}$ E., and steer in on that course, passing across the *red* sector of St. Ann's high light shown over Chapel and Thorn rocks; as soon as the vessel is northward of the *red* sector, steer E. by N., which course will lead from 2 to 3 cables northward of Thorn rock buoy in 8 to 9 fathoms.

When Thorn island bears about S.S.E., or the lower Castle head light N.E. $\frac{1}{2}$ N., steer E.S.E., till the upper light of St. Ann's is in line with Thorn island fort; from this position the Stack fort should bear about N. $\frac{1}{2}$ E., and the vessel be in mid-channel; thence steer E. by S. $\frac{3}{4}$ S. until Castle head lights are about in line with the Stack fort, when anchor in 11 to 12 fathoms; or if the *fixed red* light on Newton Noyes pier can be identified, it may be steered for, bearing E. by S. southerly, until abreast of Popton and Hubberston forts, or even to Milford; the bottom eastward of Angle bay is of mud, whereas westward of it, abreast the Stack, it is rocky in places. In thick or hazy weather, it would not be prudent to attempt to pass beyond Stack fort.

It is not advisable for strangers to proceed above Milford at night; but if wishing to do so, and having passed about one cable southward of Newton Noyes pier, steer about S.E. by E. gradually bringing the dockyard lights in line, or keeping the eastern light a little open northward of the western one, which leads northward of Pwllcrochan

flats; when nearing Weare point, the eastern light should be opened a little southward of the western one, to clear Weare tongue spit and buoy, when haul north-eastward for the mooring buoy and anchor as convenient.

The Great Western Railway steamers proceed to their pontoon at night, with the assistance of their lights placed westward of Neyland, and which are exhibited every night, Sundays excepted.

From abreast Weare buoy, the Church lake lights are steered for, in line, bearing E. by N. $\frac{1}{4}$ N., until Hazel beach lights are nearly so, when the vessel will be northward of Carr spit; these latter brought in line astern bearing N.W. by W. $\frac{1}{2}$ W., lead northward of Carr spit, close to the north edge of Dockyard bank in 13 feet water, and southward of Neyland spit; consequently the back light should be kept open northward of the front one when abreast Dockyard bank. When the pontoon lights are in line with the small floating light at the end of the landing pier, the vessel is eastward of Neyland spit and the pontoon is steered for.

The ebb tide is strong here at springs, particularly when there are freshets from the upper river.

TOWNS, &c.—MILFORD is well situated for a seaport town. It was founded in 1790, and rose into some importance with the establishment of a Government dockyard, and was proportionably checked when this was transferred to Pater, now known as Pembroke dock; but with the extensive dock accommodation now created (page 108), hopes are entertained of its rising to considerable importance. The town is situated on the north side of the haven, about 5 miles from the entrance, on an elevated position having a commanding view of the harbour. It is built in three terraces, and presents a picturesque appearance from the water. The Great Western railway station is at the back, or north-west end of the town.

Castle pill, an inlet about 8 cables in length, at half a mile eastward of Milford, dries at low water; its entrance is spanned by a swing railway bridge.

Coasting craft are repaired in the Pill.

Newton Noyes pier, about 200 yards in length, with a depth of 15 feet at low water at its extreme, lies nearly one mile eastward of Milford docks, and is in connection with the railway; vessels are coaled here from hydraulic shoots, but due notice must be given. *See light, page 100.*

Population of Milford in 1881 amounted to 3,812.

MILFORD WET DOCK.—The Milford dock is situated at the mouth of Hubberston pill, between the town of Milford and its suburb of Hakin, and has a frontage of about 1,700 feet.

The entrance lock is 550 feet long and 70 feet wide, with 34 feet of water over the sill at high-water spring tides, and the same depth of water in the approach; this entrance lock opens into a wet dock having an area of about 15 acres, with a depth of 34 feet over the greater portion of it. By the side of the entrance lock, and parallel with it, is a graving dock 600 feet long and 70 feet wide, with 34 feet of water over the sill at ordinary spring tides; it can either be used as a graving dock, or as a wet dock for loading or discharging cargo. The wet dock quays are fitted with two travelling steam cranes capable of lifting from 2 to 3 tons, several hand cranes, capstans, bollards, and all other conveniences for loading and unloading vessels; railway lines are laid on the quays in connection with the Great Western railway.

Buoys.—The approach to the dock is marked by two buoys on each side of the dredged channel, which has a depth of 12 feet at low water springs; the two outer buoys are placed in 6 feet water, about 130 yards apart, the two inner, at about half-way to the dock entrance; the starboard hand buoys, on entering, are black and white chequered, and the port hand red and white chequered; all these are surmounted by a staff with diamond.

Signals.—When the dock gates are open, a blue flag is shown by day from the flagstaff on the east pier head. At night, two *green* lights are hoisted vertically. As before stated, a *red* light is shown on the west pier head from sunset to sunrise.

Supplies.—Ordinary supplies of provisions and water can be obtained at Milford.

Coal may be obtained alongside Newton Noyes pier (p. 107).

Repairs.—Very light repairs are undertaken by the Castle Steel and Iron Works, in Castle pill. Trade, *see* p. 110.

PEMBROKE DOCK, or Pater, is 3 miles above Milford, and rose with the establishment of the Government dockyard, before which time it was but a small village. It has several streets of houses, inhabited almost entirely by dockyard workpeople, and all the requirements of a thriving and populous town, including an enclosed market place. The town is municipally connected with the ancient borough of Pembroke, distant by road about 2 miles.

The population of the boroughs of Pembroke and Pembroke Dock in 1881 was 14,156, of which 10,261, including naval and military establishments, belonged to Pembroke Dock.

THE ROYAL DOCKYARD is comprised in an area of 80 acres, surrounded by high walls ; there are 12 building slips and one dry dock (*see* below), with all the necessary works for both wood and iron ship building of the largest class, residences for the principal officers, and a chapel. The dockyard is connected by a branch line with the Tenby railway, thence with the Great Western.

Pater fort is situated at the north-west extreme of the dockyard.

Signal station.—On the south-west corner of the Saw Mill roof, at about 50 feet above high water, is a flagstaff and semaphore for communicating with H.M. ships in the haven. Also a gas light for flashing signals at night. The dockyard is connected with St. Ann's head by telegraph, page 93.

Wharf.—At **Hobbs point** wharf there is a depth alongside of about 12 feet at low water ; but a vessel moored off about 50 feet will have depths alongside of 4 to 5 fathoms. The large ships built in H.M. dockyard here receive their boilers and heavy machinery under the steam crane, which will lift a weight of 32 tons.

The landing slips in H.M. dockyard and at Neyland will just admit of a boat landing at low water.

The ferries across this part of the Haven are from near the west end of the dockyard to Weare point, and from Pembroke point above, to near the Trinity wharf, besides the steam ferry between Hobbs point and Neyland.

Neyland or New Milford, situated opposite Hobbs point, is the terminus of the Great Western railway ; its inhabitants are people employed in H.M. dockyard, and by the Great Western railway and their steamers. The railway is in connection with the steamer pontoon, 950 feet in length, by hydraulic lift, and the pontoon has depths of 12 to 14 feet alongside at low water.

Trinity establishment.—Nearly three-quarters of a mile above Neyland, on the same side, is the establishment of the Trinity House, with a jetty about 250 feet long, but dry about 3 feet at low water ; also works and storehouses required for the maintenance of the lighting and buoying of the district.

Supplies of every description are abundant, except water. H.M. Ships are watered by tank from H.M. dockyard with water from Government reservoir. The Great Western have water laid on to the pontoon.

Coal.—Vessels are coaled here by lighters, and, except during violent gales, there is no interruption.

Sufficient water for the small coasting trade can be procured at Church-lake, Neyland, and Pembroke ferry.

Docks.—The Dry dock at H.M. dockyard is 404 feet in length overall, 75 wide at the entrance, with a depth on sill of 25 feet at high water ordinary springs.

The dry dock at Pembroke dock, in Lanion pill, is 200 feet in length, 50 feet wide in the entrance, with a depth over sill of 15 feet at high water springs. Wooden vessels are repaired in the yard in connection with this dock.

The Great Western railway have a gridiron at Neyland, for the use of their own steamers, of about 12 feet draught.

Repairs.—There are no facilities for the repairs of machinery of merchant vessels at Pembroke dock; the Great Western railway have a machine shop for the repair of light defects to their steamers and locomotives. *See Jacob's pill, page 104.*

Communication.—As previously stated, the Great Western railway has a terminus here. There is also steam communication by Great Western railway steamers with Waterford daily, carrying the mails, starting at 2.30 a.m. and arriving back about midnight.

There is also steamer communication with Cork three times weekly; steamers from Bristol to Liverpool, and Bristol and Wexford call once a week.

Trade.—There is a small coasting trade only at present with the Haven, but much is expected from the development of Milford dock. In the year 1888, 1,592 vessels entered, of the aggregate tonnage of 353,356 tons, but most of these entered from stress of weather; as many as 500 vessels have been in the Haven from this cause at one time, though the occasions are rare.

The mackerel trade causes some excitement in the spring, when numbers of steamers continually arrive with the produce of the catches off the south coast of Ireland.

Eastern and Western Cleddau, Haverfordwest, &c.—The eastern and western Cleddau, which discharge into Milford haven, have their sources among the Precelly mountains, and from the neighbourhood of Fishguard; the first becomes navigable at Blackpool, and the other at Haverfordwest, and uniting at Picton point, the combined stream flows by Langum and Laurennny to the haven.* There are several local pilots for the river, and their services are necessary, as no intelligible sailing directions for its navigation can be supplied.

* *See Admiralty plan:—Cleddau river from Pembroke dockyard to Haverfordwest, No. 2,858; scale, $m = 4\cdot3$ inches.*

Between the Trinity Wharf opposite Pembroke ferry, and Laurennny, there are many places for anchoring in perfect security with good holding ground, it is equally good just above Benton castle in 5 fathoms, but a bar of stones, with only 9 feet over it at low water, crosses the river a little below. At Laurennny two creeks diverge from the river, one to the eastward $2\frac{1}{2}$ miles to the village of Cresswell, where there is a rise of 12 feet at springs; the other to the south-east $2\frac{1}{2}$ miles to Carew bridge. These creeks are nearly dry at low water, but at high tides are navigable for vessels of 8 feet draught.

Above Laurennny deep water skirts the shore to Garron pill; but from thence the Tuns rocks dry out nearly half-way between the high water shores abreast of Benton wood, and extend up for about one-third of a mile. Along the west shore there is a good depth to Langum pool, where there is safe anchorage in 3 fathoms, muddy bottom. Langum is the residence of most of the men and women employed in the Milford oyster and other fisheries. Above Langum the depths become more shallow and irregular to the anchorage off Landshipping pier, in 2 fathoms at low water, and farther up vessels lie on the ground as the tide ebbs.

From near Landshipping the two branches of the river diverge; the eastern one is nearly dry at low water, but to vessels drawing 8 feet it is navigable at high water springs to Blackpool, which is 4 miles from the bridge. The western one is available for vessels of greater draught up to Little Milford quay, $2\frac{1}{2}$ miles distant, where the tidal rise is 19 feet at springs, and $13\frac{1}{2}$ feet at neaps; it is also the limit of a spring tide low water.

At about 2 miles above Little Milford quay is the town of Haverfordwest; to it the bed of the river rises considerably, so that only vessels of a less draught than 9 feet can get to the quays during springs; the ordinary rise at that time being 7 feet, and the time of high water being half an hour after that at Pembroke dock. Haverfordwest, a parliamentary borough and county town, is situated on the right bank of the river, which is crossed by two bridges. Its trade is chiefly domestic and in agricultural produce. The population of the borough in 1881 was 6,398. About a quarter of a mile below the town the river is crossed by the Great Western Railway, having a lifting bridge to allow the passage of small coasters. Considerable quantities of limestone and lime, with some coal, are shipped from the various quays along the river and arms of the haven, and there are ferries at Landshipping, Langum, and Laurennny.

Tides.—It is high water, full and change, at Laurenný at 6h. 23m. local time; springs rise 20 feet, and neaps $14\frac{1}{2}$ feet; the flood at springs runs 3 knots an hour, and the ebb $2\frac{1}{2}$ knots.

COAST.—**West Freshwater bay.**—Sheep island, situated at the south-east point of the entrance to Milford haven, is about 2 cables in length, and connected to the adjacent point by a ledge which dries at half ebb. From Studdock point abreast it, bold cliffs extend for 2 miles in a south-east direction, the coast thence turning out nearly at right angles for $2\frac{1}{2}$ miles to Linney head. Between, is West Freshwater bay with its sandy foreshore. Bluck's pool in the south-east corner has on its northern side a spit of shelving rock named the Pole, extending out one-third of a mile and causing an interruption to the tidal stream.

The bay offers fair shelter with off-shore winds, in depths not less than 9 fathoms, sand; inside this depth the bottom is foul. If caught in a sailing craft, with an on-shore wind, it is better to work out on the southern or Linney head side of the bay, as both the flood and ebb stream set round from Sheep island; the eddy on the ebb extends about one mile off, uniting with the true tide which runs out towards Turbot bank.

LINNEY HEAD lies $5\frac{1}{2}$ miles south-eastward of St. Ann's head; its summit is a flat down, with dark perpendicular cliffs 150 feet in height; straggling rocks project from their bases for the distance of a cable, the principal of which are the Brimstone to the northward always above water, and the Linney, immediately off the head, which covers at high water.

The Coastguard watch-house near the edge of the cliff is a conspicuous object. There is a detachment also at Flimston.

Flimston head.—The coast between Linney and Flimston heads and onward to St. Goven's head, is of the same bold character, indented by deep fissures and chasms, with insular masses of cliff, locally known as stacks, detached but a few feet; these, being the favourite haunts of numbers of sea birds, have become whitened by their deposits, and offer prominent marks whereby to recognise the coast in thick weather; one particularly, called Pen-y-holt stack, three-quarters of a mile from Linney head, is a good mark for indicating the position of the Crow and neighbouring rocks which lie abreast.

Patches of 3 fathoms lie about $1\frac{1}{2}$ cables off Flimston head; there are no dangers off this portion of the coast beyond three-quarters of a mile.

Temporary anchorage about one mile off, in from 10 to 15 fathoms, may be taken by coasters waiting for favourable tide, over a gravel but irregular bottom.

In the offing this part of the coast may be further identified by the conspicuous churches of Warren and St. Twinels, the first with a dark brown tower, the latter having a tall spire; they stand about 2 miles inland.

CROW ROCK.—Beacon.—The Crow rock lies South $5\frac{1}{2}$ cables from the Linney head watch-tower; it is not more than 20 feet across, and dries 18 feet at low-water springs, with depths of 7 to 9 fathoms close-to outside. The rock is marked by a red pyramidal beacon surmounted by a staff and ball.

Toes.—Near the Crow are several straggling rocks named the Toes: that $2\frac{1}{2}$ cables N.W. by N. of the Crow beacon is about one cable in extent, with its highest part nearly awash at low water; there are depths of 5 to 6 fathoms close-to on all sides.

East Toe, with 15 feet at low water, lies E.N.E. one cable from the Crow, and has from 4 to 5 fathoms close around it.

South-east Toes, the outer of which, nearly awash at low water, lies S.E. $\frac{3}{4}$ S. distant $5\frac{1}{2}$ cables from Crow beacon, consist of two heads one cable apart; the inner rock has 3 feet over it. A depth of 9 fathoms will be found seaward of them, with 5 fathoms close inside, and 8 to 9 fathoms between them and the Crow.

Clearing marks.—The Coastguard station over the north-east end of West Freshwater bay, in line with Brimstone rock, kept well open of Linney head, leads westward of the Crow and Toes; and St. Ann's lighthouses in line N.N.W. leads one-third of a mile south-westward of them; St. Goven's head, open of Saddlehead, also leads southward; while Pen-y-holt stack bearing North leads eastward of them.

When the Crow rock is covered, there is not less than 18 feet over the Toes, but in thick weather it is not prudent to approach the latter in a less depth than 20 fathoms over coarse sand and gravel, for, besides the soundings being irregular, the north-western tidal stream sweeps towards West Freshwater bay close round the rocks.

Crow sound.—Between the Crow group of dangers and the foul ground fronting the shore, is Crow sound, 2 cables wide in its narrowest part, with a least depth of $3\frac{1}{2}$ fathoms on the leading mark; namely, Saddle head just open of Flimston head S.E. $\frac{3}{4}$ E.; but the passage should not be attempted in a sailing vessel except with smooth water and a leading wind.

Elegug stacks are two remarkable and nearly perpendicular rocks in a bight, situated half a mile eastward of Flimston head ; they are the resort of guillemot and puffin and other seabirds between the months of May and August.

The **Coastguard** flagstaff stands on the cliff close westward of the Stacks.

Saddle head lies about $2\frac{1}{2}$ miles eastward of Flimston head. Between the heads, eastward of the Elegug stacks, are Flimston and Bullslaughter bays, with boulder beaches and precipitous cliffs ; it is seldom that landing could be effected here.

Patches of foul ground lie about one cable off shore abreast Flimston bay, Mewsford point, and the Castle point.

ST. GOVEN'S HEAD*, one mile eastward of Saddle head, is the southernmost projection of Pembrokeshire ; it is a perpendicular limestone cliff 122 feet high, quite bare to its base. The back land is nearly level, and among the more conspicuous of its objects is the dark square tower of St. Petrox church, $2\frac{1}{2}$ miles within the head, and elevated 307 feet above high water. Upon a shelf half-way up the cliff, half a mile westward of the head, are the old chapel and well of St. Goven, the former being a small rude structure with a belfry ; both objects of local reverence.

St. Goven's head, from its prominence and comparative safety of approach, is often made the first landfall by homeward bound vessels.

A spit extends about 6 cables W. by S. from the head, with a depth of $2\frac{1}{2}$ fathoms near its extreme. Patches of 5 fathoms, rock, lie S.E. distant $1\frac{1}{2}$ miles, and E. by S. $\frac{1}{2}$ S. $1\frac{1}{3}$ from the head ; and patches of 7 to 9 fathoms exist at $3\frac{1}{2}$ to 5 miles in the same direction. A tidal race extends about half a mile off the head.

Coastguard.—A Coastguard watch-tower and flagstaff stand on St. Goven's head ; there is also a life-saving apparatus (cliff ladder) house near it. The station is known as Castletank.

St. Goven's shoals, consisting of three dangerous rocky patches, steep-to, lie between $2\frac{3}{4}$ and 4 miles south-westward of the head ; the inner patch of $3\frac{1}{2}$ fathoms, lies with St. Goven's head bearing N.E. $\frac{1}{4}$ E., distant $2\frac{3}{4}$ miles ; a patch of 4 fathoms lies half a mile south of it : the outer and south-western patch, of $3\frac{1}{2}$ fathoms, lies with the head bearing N.E. by E. distant nearly 4 miles. Patches of 9 fathoms lie north-westward of these.

Caution.—The overfalls over this uneven ground, and the breaking seas in heavy weather, which might prove destructive to laden coasters, render an offing of 4 to 5 miles advisable.

* See Admiralty charts ; St. Goven's head to the Mumbles, No. 1,076, and No. 1,179.

New quay—Landing.—A sandy cove, or break in the cliffs, named New quay, lies 2 cables northward of St. Goven's head ; here landing may be effected when it is not practicable on other parts of the neighbouring coast.

Broad haven.—Northward of New quay, in the centre of the bight formed between St. Goven's and Stackpole heads, is Broad haven, into which the tide flows one-third of a mile at high water. The valley in continuation of the haven is crossed by gates, which retain the ornamental waters of the park of Stackpole court ; and Bosherston church, stone-coloured and with a square steeple, stands at the head of the valley, but it is only seen when closing St. Goven's head from the eastward.

Broad haven at its entrance is $1\frac{1}{2}$ cables wide, and distant one cable from its eastern point is the stack, a rocky and conical islet, which, with the valley and wooded heights of Stackpole court, are sufficiently remarkable to render the haven easily distinguishable by any vessel so distressed in a south-west gale as to render beaching necessary. For this purpose Broad haven is to be preferred to any other spot between Milford and Tenby, and it is only necessary on entering to pass one cable westward of Stack rock. These coves are occasionally available for the discharge of coal, &c., and when landing is practicable a good supply of water may be obtained at Broad haven.

Stackpole head is equally bold as that of St. Goven's, but its outline is much sharper, and the extreme of the head is detached to within a few feet of the top. About three-quarters of a mile southward of it, are some oyster beds, in depths of 5 to 13 fathoms. Eastward of the head, within a distance of 2 cables, are some rocky patches of $4\frac{1}{2}$ fathoms.

Stackpole quay and road.—From Stackpole head the coast line falls sharply back in a northerly direction for three-quarters of a mile to Stackpole quay, a small stone jetty in a nook of limestone quarries. About midway between it and the head, and abreast the small sandy cove named Little haven, is Stackpole road, offering a more sheltered anchorage than Broad haven, in about 6 fathoms, sand. Vessels at anchor off this exposed coast must be in readiness to weigh, as southerly winds soon raise a heavy sea.

East Freshwater, Swanlake, and Manorbeer bays.—From Stackpole quay the character of the cliff changes from limestone to dark brown sandstone, and the coast trends eastward for nearly 2 miles to East Freshwater bay (locally known as Fresh-

water East), which is half a mile broad and backed by high sand-hills, through which issues a considerable stream. At low water a broad beach, with a margin of sand, dries $1\frac{1}{2}$ cables from the head of the bay. Three cables off Trewent point, is a patch of $2\frac{1}{2}$ fathoms, over which there is a considerable rip during the strength of the tide.

From East Freshwater bay, the coast trends in a south-easterly direction nearly 3 miles to Old Castle head; between is the small sandy indentation of Swanlake, dividing Westmoor and Eastmoor cliffs; and Manorbier bay, which is backed by low sand-hills. At the head of the latter bay is the dark and conspicuous ruin of the Norman stronghold, and a church a little up and on the south side of the valley, beyond which is the village of Manorbier. A rock nearly dry at low water, lies near the centre of this bay, with 5 fathoms just outside it.

Old Castle head, the termination of a rather higher background, has a distinct and bold summit, 213 feet high, capped by some old entrenchments, from whence it slopes to the shelving rocks surrounding it. A ridge of loose sand and gravel with general depths of 4 and $4\frac{1}{2}$ fathoms, and 6 and 7 fathoms on either side, stretches from Manorbier bay to nearly abreast Old Castle head, at an average distance of one-third of a mile from the coast, but at its eastern termination is a rocky head, with 9 feet only, with the extreme of the head bearing E. by N. distant $4\frac{1}{2}$ cables. The first valley extending to the coast westward of Lidstip point, kept well open of Old Castle head, leads south-eastward of it.*

Skrinkle haven is a small bight in the coast northward of Old Castle head, and affords landing in fine weather.

Lidstip bay.—Lidstip point, one mile eastward of Old Castle head, is a narrow ridge of limestone 140 feet high, with a depth of 5 fathoms at one cable from its southern and eastern sides. Between it and Skrinkle haven, are some remarkable caverns which can only be visited at low water. From a quarry a short distance within the point on its northern side, quantities of limestone are conveyed by coasters to the ports on the opposite side of the Bristol channel. Lidstip bay is skirted by a low shore and a broad strip of shingle with large stones; the depth between Lidstip point and Proud Giltar is but $2\frac{1}{2}$ fathoms, sand whence it gradually shallows to the shore and is therefore, only adapted to afford shelter to vessels of light draught in westerly winds.

Lidstip house stands close to the high-water mark at the south-west corner.

*See Admiralty plan, Tenby and Caldy roads, No. 1,165; scale, $m = 4\cdot0$ inches, with view of the coast.

Proud Giltar.—From Lidstip bay a line of nearly perpendicular indented cliffs, extend eastward for $1\frac{1}{2}$ miles to Giltar point; the highest of these cliffs, named Proud Giltar, is elevated 170 feet and overhangs its base. From the foot of the cliffs, in which are several deep caves, sunken rocks extend in several places to the distance of one cable. From the summit of the cliffs a flat extends inwards for one-quarter of a mile, which is succeeded by a valley and thence by the high background named the Ridgeway, which extends westward nearly to Pembroke.

Giltar point is a narrow projection of limestone, 100 feet in height, not quite so high or precipitous as Lidstip. A quarter of a mile within the point, low sand-hills commence, fronted by the South sands, both of which extend as far northward as the promontory on which the town of Tenby stands.

Penally church, with its cottages and villas lie at the back of the sand hills, and below the Ridgeway; an old mill stands over Hol-loway marsh at the north-east extreme of the Ridgeway. Northward of Giltar point, the low-water shore is composed of large stones for a quarter of a mile, thence the South sand dries to St. Catherine islet, having about midway a projection of sand and muscle-scar named Giltar spit, at half a mile or more off the high-water line.

CAERMARTHEN BAY lies between Caldy island and Worms head, and is nearly 14 miles wide, by about 9 miles in depth. From its head branches Caermarthen and Laugharne inlets, and farther eastward the more important one of Burry. The bottom generally is of sand, shells, and some mud, and without obstructions outside of the 5-fathom line except round Caldy, to be hereafter described.

The portion of Caermarthen bay within the 3-fathom line of soundings is locally known as the White bank.

Tidal streams.—The ebb stream sets out from Caermarthen inlet towards Caldy, and from Burry inlet towards the centre of the bay, at the rate of between 2 and 3 knots at springs, the influence of the latter being felt about 6 miles beyond the limits of the bay.

During westerly gales a very heavy sea is thrown into Caermarthen bay, and in consequence of the dangerous nature of the sands extending along its eastern portion, the greatest caution is necessary in a sailing vessel to prevent getting embayed. Numerous instances have occurred in which vessels seeking shelter up the Bristol channel during thick weather have been stranded on these sands.

CALDY ISLAND, on which there is a lighthouse, is separated from Giltar point on the mainland by a sound half a mile wide. The island is $1\frac{1}{4}$ miles in length, by two-thirds of a mile in breadth, and very irregular in its outline and feature ; the character of its coast is mostly cliff of moderate elevation, the highest being on the southern and north-eastern sides. The summit of the island, 170 feet, is near Red Ord point, the south-west end. Close to the shore are some detached rocks, or stacks, the two principal being on the north-east end, viz., Spur islet off Small Ord point, and High cliff north-west of it. The low-water feature is chiefly rock, with shingle and sandy bights, none extending beyond two-thirds of a cable.

The island contains 650 acres of surface, the greater part of which is cultivated. The inhabitants consist principally of quarrymen and farm labourers, who, together with the families of the proprietor and the light-house keepers, number about 90. The ruins of an old priory, with a small square tower and spire, still remain, and is attached to the mansion of the proprietor. There is a good well of water on the island but inconveniently situated for supplying vessels.

Limestone is quarried in the island, and shipped in considerable quantities.

The landing place is on the north side, in Priory bay.

LIGHT.—Caldy lighthouse stands about 180 yards within the southernmost bluff of the island, and is a circular white tower 52 feet in height, supported on either side by the light-keepers' residences. The light exhibited therefrom is an *occulting light*, *twice every half minute*, elevated 214 feet above high water, and visible in clear weather from a distance of 20 miles. It shows *white* to seaward ; *red* in the direction of Old Castle head, between the bearings of S. 72° E., and S. 58° E. ; and *red* also in the direction of Woolhouse rocks and High cliff bank, or between the bearings of S. 53° W. and S. 13° W. Over the remainder of the circle, including Caldý road, the *white* light will be seen, except when obscured by the land.

Beacon.—Nearly half a mile north-eastward from the light-house, near the edge of the cliff, is a small obelisk intended as a day-mark for Woolhouse rock.

St. Margaret's island, situated 2 cables north-westward of Caldý, is about one-quarter of a mile long by 200 yards wide, with an irregular formation and a barren surface, and bounded on all sides by dark brown cliffs upwards of 100 feet high, perforated by caverns and limestone quarries. At low-water the two islands are

connected by a rocky neck, $1\frac{1}{2}$ cables broad ; the southern portion is covered at $2\frac{1}{2}$ hours flood, and the whole of it at 24 feet rise. Very little low water feature projects beyond the foot of the cliffs.

A patch of 9 feet lies about W.N.W., $1\frac{3}{4}$ cables from the north-west extreme of the island, with depths of 4 fathoms extending about the same distance southward of it ; a patch of 3 fathoms also lies $1\frac{1}{4}$ cables southward of the island.

CALDY SOUND AND ROAD.—Caldy sound is the channel about half a mile in width, formed between Caldy island and Giltar point, about $1\frac{1}{2}$ miles southward of Tenby. The road under Caldy island affords considerable shelter, and is much used by coasting craft during southerly gales ; there is anchorage in from $2\frac{1}{2}$ to about 5 fathoms, and there is a hole with from 5 to 9 fathoms, 2 cables in length east and west, by about 4 cables north and south ; the western channel to the road has 4 fathoms at low water, between Eel and Giltar spit buoys ; whilst the eastern channel has only 3 fathoms, but there is about 5 fathoms at half tide.

Caldy sound would also afford temporary shelter to larger vessels during south-east gales, in about 8 fathoms, north-eastward of St. Margaret's island, especially towards low-water, when the ledge connecting Caldy and that island would be nearly dry, but they must be prepared to put to sea, or to run eastward through the Sound when the tide permitted, should the wind shift to the westward, which is usually the case. *See* anchorages, page 122.

Dangers in the approaches, &c.—**Offing patches** are two groups of foul ground, lying southward of Caldy island ; the western portion is about half a mile in length, and very narrow ; the least depth $4\frac{1}{6}$ fathoms lies with Red Ord point bearing N.N.E., distant three quarters of a mile ; the eastern portion, also with a least depth of $4\frac{1}{6}$ fathoms, is about $2\frac{1}{2}$ cables in extent, with Red Ord point bearing N. $\frac{1}{2}$ W., distant $1\frac{1}{2}$ miles.

Woolhouse beacon open of the east end of Caldy, leads eastward of them, and Tenby church spire open westward of Caldy (seen through Small sound), leads westward of them.

Drift rock is about one cable in extent, with a least depth of $4\frac{1}{2}$ fathoms, lying with Caldy lighthouse bearing N.N.W. distant $1\frac{1}{3}$ miles ; the rock is the extreme of the spit, under 10 fathoms of gravel and rock, extending south-eastward of Caldy. The tidal stream from Caermarthen bay setting over the rock, causes at times a considerable sea.

Trawlers' dread, a patch of 7 to 8 fathoms, foul ground, about 3 cables in extent, with 12 to 13 fathoms around it, lies with Caldý light bearing N.W. by W. $\frac{1}{2}$ W. distant $4\frac{1}{2}$ miles.

Spaniel shoal is a ledge of sharp-pointed rocks off small Ord, or eastern point of Caldý island, the shallowest spot, 10 feet bears S.E. $\frac{1}{2}$ E. $3\frac{1}{2}$ cables from it; other patches lie between Spaniel shoal and the island.

A patch of $4\frac{1}{2}$ fathoms, rock, lies half a mile eastward of Spaniel shoal, with Caldý lighthouse bearing W. $\frac{3}{4}$ N., distant $1\frac{1}{2}$ miles; and a patch of $4\frac{1}{2}$ fathoms, sand, lies 3 cables E.N.E. of it. All these patches break in southerly gales.

Buoy.—A can buoy, chequered red and white, in 6 fathoms, lies 2 cables south-eastward of the shallow head of Spaniel shoal, with Caldý lighthouse bearing W. by N. distant 9 cables.

Clearing mark.—Monkstone in line with Woolhouse beacon, leads eastward of Drift rock and Spaniel shoal, but only about 150 yards westward of the $4\frac{1}{2}$ fathoms patch, above referred to.

Lidstip ledge lies in the fairway of the western approach to Caldý sound, and within a depth of 5 fathoms, it is $1\frac{1}{2}$ cables in extent; the shoalest spot, 10 feet, lies with the west extreme of St. Margaret's island bearing S.E. by E. $\frac{1}{2}$ E., distant $6\frac{1}{2}$ cables. Patches of $4\frac{1}{2}$ fathoms lie westward of it.

Sound rock, with a depth of 14 feet, lies $1\frac{1}{2}$ cables S.E. by E. of Lidstip ledge; with 5 to 7 fathoms at a short distance from it.

A patch of 9 feet, lies $1\frac{1}{2}$ cables westward of St. Margaret's, leaving a channel between it and Sound rock $3\frac{1}{2}$ cables wide, with depths of about 7 fathoms.

Eel and Giltar spits.—Eel spit is the termination of a narrow rocky ridge, with from one to 2 fathoms water, and from 5 to 6 fathoms close to, extending 4 cables northward of Eel point, and half-way across Caldý sound. The navigable channel is here only three-quarters of a cable wide, with 4 fathoms least water.

A dangerous cross sea, named the "Fiddlers" by the pilots, break over the ridge with a strong wind and weather tide.

Giltar spit is the tongue of the South sands, dry at low water for half a mile off the coast northward of Giltar point and the same distance north-eastward of that point; the tongue under water, with depths of less than 6 feet, extends nearly half a mile beyond the dry portion. The south edge of the flat, extending into Caldý sound, to within three-quarters of a cable of Eel spit, has a depth of 10 feet only just within its edge.

Buoys.—The north extreme of Eel spit is marked by a red conical buoy in $3\frac{1}{2}$ fathoms, with Eel point bearing S.W. by S. distant $3\frac{3}{4}$ cables. Giltar spit buoy, a red and white vertically striped can buoy, in 3 fathoms, lies N. $\frac{1}{2}$ E. distant 150 yards from Eel spit buoy.

High cliff bank, about 4 cables in extent, with depths of 9 to 10 feet at low water, lies about 4 cables off the north-east side of Caldý island, on the sand flat fronting the island, and forming the south-east side of Caldý sound. The channel between the bank and the island, close southward of South High cliff buoy, has 15 feet depth at low water and is available for entering Caldý road from the south-eastward.

Buoys.—The northern end of High cliff bank is marked by a red and white chequered can buoy in 3 fathoms, with Woolhouse beacon E. $\frac{3}{4}$ N. distant 7 cables. The south-east end of the bank is marked by a red conical buoy in $2\frac{1}{2}$ fathoms, with Woolhouse beacon N.E. by E. distant $9\frac{1}{2}$ cables.

Woolhouse rocks is a narrow ledge of rocks, about 3 cables in length within a depth of 3 fathoms, in a north and south direction, and situated about one mile north-eastward of Highcliff bank. Its centre portion to the extent of one cable, is awash at half tide.

Beacon.—Upon the centre of the rock is a pyramidal beacon of masonry, surmounted by a staff and ball, 46 feet above high water.

The Yowan is a patch of foul ground, about $1\frac{1}{4}$ cables in extent within a depth of 4 fathoms, with one spot of $2\frac{1}{2}$ fathoms situated with Woolhouse beacon bearing W. $\frac{1}{2}$ N., distant $1\frac{1}{10}$ miles. The ground is somewhat irregular westward of the Yowan. Tenby spire in line with north extreme of St. Catherine's island N.W. by W. $\frac{3}{4}$ W. leads northward of the Yowan.

TIDES.—It is high water, full and change, about Caldý and Tenby, at 5h. 55m. local, or 6h. 13m. Greenwich time. Equinoctial springs rise 28 feet ordinary springs $25\frac{1}{2}$ feet, and neaps 19 feet, the range of the latter 13 feet. South-westerly winds cause the tides to rise higher and earlier, and north-easterly have the contrary effect.

The eastern stream through Caldý sound begins about 4 hours ebb by the shore, or about one hour before high water at entrance to Liverpool; with a rate at springs of 3 to 4 knots, and at neaps $1\frac{1}{2}$ to $2\frac{1}{2}$ knots per hour; the western stream begins at about 4 hours flood on the shore, or one hour before low water at entrance to Liverpool. Close to the mainland between Giltar point and the Monkstone northward of Tenby, the stream sets north-eastward from one hour before

until one hour after low water by the shore, when it turns and sets south-westward meeting the Sound stream at Giltar point, thence westward, causing a strong eddy for a distance of 50 yards off the point.

ANCHORAGES.—Three anchorages around Caldy, more or less valuable according to wind and weather, are as follows :—

Caldy road, in Caldy sound, abreast Priory bay, on north side of Caldy island, is formed between Eel point ridge and High cliff bank; the depths vary from $2\frac{1}{2}$ to 7 fathoms with good holding ground. The tides are strong, but it is the safest anchorage for vessels of 12 feet draught and under, and is sheltered from all winds except those from N.E. to S.E. For an anchorage in about 4 fathoms, the marks are Caldy lighthouse midway between the spire and magazine S. $\frac{1}{4}$ E.; and Skrinkle haven just open northward of St. Margaret's island W. by N. $\frac{1}{4}$ N. There is also capital anchorage westward of that position, just eastward of Eel and Giltar Spit buoys, in what the fishermen call Bog hole, in 5 to 7 fathoms, stiff mud, with Caldy lighthouse in line with the magazine. The tide runs strong here at springs.

Should it be necessary to get under way and run out to the westward, it may be well to bear in mind that there will not be less than 19 feet over the Eel ridge at half-tide; and proceeding eastward, northward of High cliff bank, there is not less than 19 feet at low water in the fairway of Caldy sound.

Anchorage westward of Eel and Giltar spit buoys, is not recommended by the pilots as the holding ground is bad, but the depth of water is sufficient for all draughts, with some shelter from south-east gales. Vessels could run eastward through the sound when the gale shifted to the westward, with a least depth of 19 feet at low water, and 33 feet at half-tide.

Man-of-War road.—Caldy outer road, north-eastward of the island, is the only anchorage at the west end of Caermarthen bay, adapted for deep draught vessels; it affords shelter from winds between S.W. and North, in depths of from 6 to 7 fathoms, sand over tenacious clay, and there is but little tidal stream here. A good berth, in 6 fathoms, is with Shrinkle haven just open northward of St. Margaret's island, W. by N. $\frac{1}{4}$ N.; the Old Mill house on the hill northward of Tenby, in line with the Coastguard flagstaff N. by W. $\frac{1}{4}$ W.; and Woolhouse beacon N. by E. $\frac{1}{4}$ E.

DIRECTIONS.—From the westward to Caldy road and Tenby.—Having passed Old Castle head, and closed Lidstip point,

the passage northward of Lidstip ledge may be taken, in $5\frac{1}{2}$ fathoms, with Woolhouse beacon in line with Giltar point E. $\frac{3}{4}$ S. ; or if preferring the more eastern passage, Woolhouse beacon, midway between Giltar point and St. Margaret's island, bearing East, will lead between that island and Sound rock in 7 fathoms : on either course Giltar point may be approached within $1\frac{1}{2}$ cables. Having passed between Giltar and Eel spit buoys, with Proud Giltar and little Giltar cliffs in line, haul down for the anchorage in Caldý road, with the lighthouse midway between the magazine and Caldý house spire, anchoring as directed on page 122.

If bound to Tenby, from abreast Eel and Giltar spit buoys, steer a little northward of Woolhouse beacon, passing northward of north High cliff buoy, thence Caldý lighthouse kept in line with High cliff stack, astern, bearing S.S.W. $\frac{1}{2}$ W., will lead to Tenby road, and when Tenby harbour light opens northward of Castle hill, steer for it across the flat, in depths of not less than 10 feet at low water springs, anchoring if necessary in the road, or proceeding into the harbour if the tide admits. *See page 125.*

Entering Caldý road from the eastward.—Coming from the westward, by giving Caldý island a berth of $1\frac{1}{2}$ miles, the off-lying patches and Drift rock will be avoided ; or vessels may pass within these by keeping within half a mile of Caldý island, with the centre of east Freshwater bay in line with Old Castle head, astern. When Tenby church opens eastward of Caldý island, the vessel will be past Drift rock, whether passing inside or outside of it ; thence bring the Monkstone in line with, or a little open westward of Woolhouse rocks beacon, N. $\frac{1}{2}$ E., which mark will lead eastward of Spaniel shoal, and into Man-of-War road, where anchorage may be taken if necessary (page 122) ; proceeding into Caldý road, as soon as Eel point opens northward of High-cliff stack, edge towards south High cliff buoy, bringing Skrinkle haven just open northward of St. Margaret's island, which mark will lead in not less than 15 feet at low water, southward of the buoy, when anchor as directed on page 122.

If bound to Tenby, from Man-of-War road, steer with Brynhir house (a large house in the position formerly occupied by the old Mill house) on the hill over Tenby, in line with the coast guard flag-staff, bearing N. by W. $\frac{3}{4}$ W. ; this will lead between High cliff bank and Woolhouse rock, and when Caldý lighthouse is in line with High cliff stack, bring it astern and proceed as above from Caldý sound.

Woolhouse beacon may be passed on either side, at the distance of a quarter of a mile. St. Govan's head, shut in with St. Margaret's island, leads southward of it clear of danger, and also of the Yowan. The beacon on it being of considerable size may generally be made out at night.

Approaching Tenby from the eastward ; by keeping Tenby church spire in line with the north extreme of St. Catherines island, bearing N.W. by W. $\frac{1}{4}$ W., the vessel will pass northward of the Yowan, and all other dangers ; from abreast Woolhouse beacon edge northward to open Tenby pier light northward of Castle hill, which mark will lead to Tenby road and harbour.

TENBY.—This town is strikingly situated on a bold promontory, which terminates in an easterly direction in a narrow peninsula rock, on the summit of which is the small keep of a castle ruin, a monument of the Prince Consort, and the coastguard watch-house. Along the edges of the cliffs for half a mile or more, are terraces of houses, some of considerable size, and in the centre of the town the church of St. Mary, with its tall spire. Beyond the town northward, a range of cliffy heights extend for about $1\frac{1}{2}$ miles to Monkstone point, of an average elevation of 170 feet, with a rising background. Tenby is somewhat of a fashionable resort in the summer.

St. Catherine's island, on which there is a fort, lies half a cable southward of Castle head, with which it is connected by a ridge of shingle covered at half-tide ; it is 92 feet high, one cable in length, and encircled by steep cliffs, perforated at the inner end by a high cavern.

Skear rock lies half a cable off St. Catherine's island, and is nearly covered at high water springs ; at low water the rock and the fangs about it are half a cable in extent, but at half a cable outside the rock the depth is $3\frac{1}{2}$ fathoms, in the pool.

The Monkstone, 48 feet high, is the outer of two islets off the point situated $1\frac{1}{2}$ miles northward of Tenby ; its outer extreme being about one cable from the point. A ledge dries off about 100 yards beyond the Monkstone at low water, and there are rocks which dry at low water at about the same distance southward of the ledge.

TENBY ROAD is a good anchorage for vessels drawing 12 feet and under, with winds from S.W., through west, to N.E. ; the bottom is stiff mud sand-covered, and the depth $2\frac{1}{2}$ to 4 fathoms. The marks for a good berth in $3\frac{1}{4}$ fathoms, in the north part of the hole, are

Tenby church over the Castle ruin W. $\frac{1}{3}$ N., and Giltar point in line with the outer extreme of St. Catherine's island S.W. by W.

Tenby harbour has a depth of 22 feet at the end of the pier at high water springs, 19 feet at high water neaps, shoaling gradually to the head of the harbour; the pier end is dry 3 feet at springs, at which time the low water line is half a cable outside it. The depth in the harbour, however, varies, silting up at some seasons, and at others being washed away again. The harbour is formed by a strong pier, two-thirds of a cable in length in a north-west direction from the inner or north side of Castle hill, and there are quay walls around the harbour. The bottom is hard, but smooth, and in winter gales there is a considerable in-run from the sea. The coasters and fishing craft which frequent the place, moor in tiers, with their heads in.

Light.—From Tenby pier head is exhibited a *fixed red* light, visible about 3 miles.

Pilots.—Fishermen act as pilots for the harbour as well as for the neighbouring ports, their charge being by agreement.

Tides.—*See* page 121.

Directions for approaching Tenby from the westward, *via* Caldy sound or southward of Caldy island are given on pp. 122, 123. From the eastward there are no dangers; Tenby spire open northward of St. Catherine's island, leads northward of the Yowan. At night Tenby pier light in sight, bearing W.N.W. also leads northward of the Yowan, but it is not dangerous to vessels that can enter Tenby harbour.

Lifeboat and coastguard.—A lifeboat is stationed on the south side of Castle hill, and rocket apparatus at the coastguard station on the hill. This is the coastguard head-quarters for the division in the district.

Communication.—Tenby is much frequented as a watering place, and is in connection with Great Western railway. There is weekly communication with Bristol and Wexford by the steamer trading between those places.

Supplies of provisions and water can be obtained at Tenby. Water is also obtainable at a convenient stream three-quarters of a mile northward, at the mouth of the little wooded valley of Waterwinch.

Trade.—There are no exports, and the imports are confined to general goods. It is, however, frequented at times by fishing vessels

from the coast of Devon and elsewhere, who catch in the neighbourhood, in considerable quantities, mackerel, cod, herring, oysters and other shell-fish, for which they find a ready market at Bristol and neighbouring ports. The population of Tenby in 1881, within the borough bounds, was 4,750.

SAUNDERSFOOT BAY.—The Monkstone is the southern boundary of Saundersfoot bay; the small port of Saundersfoot lies one mile northward of it. The bay is fronted by a flat beach of shingle and stones intermixed with sand, which uncovers at low water for the breadth of a quarter of a mile, and affords excellent facilities for sea bathing. Besides the village of Saundersfoot there are a few white houses along the beach, and the small dark towered church of St. Issel, with a white conical top, standing half a mile inland upon the thickly wooded background, may be seen from some directions. Farther eastward, among wood, is Hean castle, under which are moderately high cliffs, succeeded by a low coast to abreast Amroth castle; half a mile inland of it is Amroth church with a square tower. At Blackhorn point, a little east of the castle, is the stream which divides the counties of Pembroke and Caermarthen.

From Saundersfoot bay eastward Caermarthen bay is shallow, there being but a depth of 3 fathoms at low water at 2 miles off shore; within that depth the shallows are known locally as the White bank.

Saundersfoot harbour.—This small harbour is formed by piers; the southern has a spur for checking the in-run of the sea. The entrance faces north, and is 35 yards wide; off it is a warping buoy.

Vessels of 16 feet draught can enter the harbour at high water springs, and those of 9 feet at neaps; the bottom on the west side of the harbour is hard, but the remainder consists of mud and sand, with a shelving beach in the north corner.

Tram-roads connect the western side of the harbour with the collieries, which are situated about 3 miles within. The exports are principally anthracite coal and culm. The copper works erected near Wisemans bridge point, about three-quarters of a mile to the eastward, are now (1889) in ruins. Good water may be obtained, at high-water, from a stream at the back of the south pier.

Light and tidal signal.—At the south pier end a yellow ball is hoisted while there is a depth of 8 feet water in the entrance; at night a *red* light is shown during the same time from an elevation of 15 feet above high-water.

Directions.—Two qualified pilots attend every tide, and whose charge is by agreement. In entering in a sailing craft, it is necessary to round the south pier head close, and check her way in time; with a swell setting on the coast there will be a considerable in-run into the harbour.

The bay has good holding ground, but as it is shallow a considerable distance off, vessels waiting tide to enter Saundersfoot should anchor with Tenby castle hill open of the Monkstone, in about 13 feet at low-water.

Coast.—Telpen point is the north-east extreme of Saundersfoot bay; its dark cliffs are backed by high and uneven ground, and through a valley may be seen the square spire of Marros church. Some flat rocks extend out from the point, and the low-water margin between them and Saundersfoot bay is sand, drying out a quarter of a mile, over which are some remains of an ancient forest.

Eastward of Telpen point, for about one mile, the bold slopes of the shore are fronted by large boulder stones, and a quarter of a mile within is Marros hill, 476 feet in height.

Ragwen point, $1\frac{1}{4}$ miles eastward of Telpen point, is shelving and rocky with a high back ground. The low-water feature continues of the same character, and to the eastward are the firm sands of Pendine and Laugharne, about 7 miles in length, extending to the junction of the rivers Taf and Towy.*

From Ragwen point the rocky coast line recedes for about one mile to Gilman and Dolwen points, at the foot of the Pendine heights, thence eastward it loses its rocky character, and it extends as a range of sand-hills for 5 miles to Ginst point. It is divided by a stream, the western portion bearing the name of Greathill burrows, and the eastern the Laugharne burrows. The marshes at the back are embanked, with a sluice gate to drain them.

TOWY and TAF RIVERS.—The estuary of these rivers in the north-east corner of Caermarthen bay, is $2\frac{3}{4}$ miles in width, between the low sandy points of Ginst and Pen Towyn.

The estuary is blocked by extensive sand banks, known as the Cefn-Sidan sands, which dry as much as 9 feet in places, and extend from $\frac{1}{2}$ to 5 miles seaward of the entrance points; these sands are liable to shift during westerly gales, and the bar should never be taken except with local knowledge.

* See Admiralty chart :— St. Goven's head to the Mumbles, No. 1,079.

Owing also to the shallowness of the water fronting the bar, and to the ground swell generally rolling up from the south-west, the locality is subject to blind rollers, very dangerous to boats.

Caermarthen bar and the channels between and westward of the Cefn-Sidan sands have only about 2 feet at low-water springs, 15 feet at half tide, and 28 feet at high water springs; within Ginst point, on west side of entrance, the river is dry at low water; it also dries between Nos. 3 and 4 buoys, but there are narrow pools of $1\frac{1}{2}$ to $2\frac{1}{2}$ fathoms between Nos. 2 and 3 buoys, and Nos. 4 and 5 buoys, in which possibly coasters could lie afloat, but the tides run with great strength.

At high-water springs there is a depth of 18 feet off Ferryside, 14 feet at Blackpool, and a vessel will carry from 10 to 11 feet to Caermarthen quay nearly 10 miles above the bar entrance; at neaps from 4 to 5 feet only.

The Towy rises in an extensive bog in the mountain region which separates Cardigan from Brecknockshire, and after a course of 63 miles reaches the town of Caermarthen, which is situated on irregular sloping ground on its north side. At Caermarthen the river becomes navigable for small craft at high water, whence it winds, with increasing breadth through pasture land and wooded bluffs for $7\frac{1}{2}$ miles to between the villages of Llanstephan and Ferryside; two miles below it enters Caermarthen bay.

The Taf rises in the Precelly mountains, in the eastern part of Pembrokeshire, passes southward of the straggling village of St. Clears, where it is joined by the Dewi-fawr; both streams, here crossed by substantial bridges, and navigable for small craft, flow onward for $4\frac{1}{2}$ miles to Laugharne, having received a little above, on the opposite side, the additional water of the Cwywyn. Here the estuary is half a mile wide, increasing to above one mile between Ginst point and Warlo bluff; from close under the cliffy shore of the latter the river passes on to its junction with the Towy at a distance of $2\frac{1}{2}$ miles from Laugharne, and 30 miles from its source.

The Gwendraeth-fawr and Gwendraeth-fach unite about half a mile below Kidwelly bridge, and passing through an extensive flat of sand and stony patches, also joins the Towy below its junction with the Taf.

Aspect.—Ginst point, though low and sandy, is well marked from being in front of a darker background. The bold headland of Warlo, elevated 350 feet, divides the Caermarthen from the Laugharne inlet; the eastern boundary of the former is near Llan Ishmael church. This church is a small building without a tower and close to

some cliffs, terminating a background which is elevated 416 feet. A mile within Warlo bluff, on the same side and on similar elevated ground, is the ruin of Llanstephan castle, and along the shore a little above, prettily situated among wood, the village with its church, and a large mansion named Plas. One mile across the river, and along the face of wooded banks, is the village of Ferryside, with its small church and railway station.

From Llan Ishmael church a range of heights extend 2 miles south-eastward; about midway is Llansaint church, with a square tower, and a few white houses near it. The high-water line, chiefly of sand-hills, skirting these heights, and along which runs the Great Western railway, rounds gradually towards the town of Kidwelly, which though standing low, is well marked by the conspicuous spire of its church, and by the ruins of its massive castle. Along the foreshore is a submerged forest containing many fossil remains.

Pen Towyn, the southern boundary of Kidwelly inlet, is also composed of sand-hills, from whence sand-hills of varying height, named Pembrey burrows extend south-eastward for nearly 4 miles to Nose point, the northern point of entrance to Burry inlet. These burrows are fronted by hard sand flats, which dry to the distance of one mile off shore.

Buoyage.—Buoys are laid down in the fairway for vessels as far up as the junction of the Towy and Taf rivers, but have constantly to be moved in consequence of the shifting nature of the sand. The outer or Fairway buoy is black conical, with staff and globe; it lies in 7 fathoms, $6\frac{1}{2}$ miles E. $\frac{1}{4}$ N., from Caldy lighthouse; and $10\frac{1}{2}$ miles nearly north from Helwick light-vessel. The Bar, or No. 1 buoy, spherical, and painted in black and white horizontal stripes, with staff and diamond, lies in 2 fathoms, N. by E. $\frac{1}{2}$ E. $1\frac{1}{10}$ miles from the Fairway buoy; at $1\frac{1}{2}$ miles E. by N. $\frac{1}{2}$ N., is the mid-bar buoy, can, with black and white vertical stripes; No. 2 buoy, about one mile within, is black conical; No. 3 is can, chequered black and white; No. 4 is black conical; No. 5 is can, chequered black and white; No. 6 is black conical, and No. 7, can, chequered black and white.

Farther up, between Warlo bluff and Llanstephan, there is a projection of sand and stones, which is marked by a white beacon: on the eastern shore, abreast Ferryside, is a high spit of shingle named the Paddock, marked at the outer end by a black beacon. Above this, the stream is confined chiefly between muddy banks with occasional patches of rock and mussel-scar.

A black conical buoy, named the Swashway, lies in $2\frac{1}{2}$ fathoms, East, distant $3\frac{1}{2}$ miles from the Fairway buoy; and S.W. $\frac{1}{2}$ S. distant

2 $\frac{1}{10}$ miles from No. 4. Westward of the two latter is a Swashway through the Cefn-Sidan sands, the one commonly used by the coasting craft.

Tides.—It is high water, full and change, at Caermarthen bar at 5h. 44m. local, or 6h. 2m. Greenwich time ; springs rise 26 feet, and neaps 19 feet. At Ferryside and Laugharne the tide is a few minutes later ; the rise at ordinary springs being 23 feet, neaps 17 feet, and duration of the flood about 5 hours. At Caermarthen and St. Clear's 6h. 28m. ; springs rise 8 $\frac{1}{2}$ feet and 9 $\frac{1}{2}$ feet respectively, and the duration of the flood is about 2h.

At Kidwelly, in the estuary, it is high water at 5h. 35m., with a spring rise of 12 feet, the flood running 2 hours. Within the bar the stream runs from 3 to 5 knots, and it should be remembered that although the flood stream sets fairly up the Towy channel, that of the ebb sets across the Cefn-Sidan sands towards Worms head until the sands are uncovered ; great care is therefore necessary when going out, to keep the vessel in the channel.

Directions.—Owing to the shifting nature of the sands, any directions but of a very general character might only mislead ; no stranger should attempt, under ordinary circumstances, to go within No. 1 buoy without the aid of a pilot. Even in fine weather an outside ground swell produces a sea dangerous for boats after half-ebb ; the tide also runs strong, and the banks of the winding channel are in some places so steep that the lead will not give the necessary warning. At half-tide a depth of about 15 feet will probably be found on the bar, with deeper pools in the channel within ; the buoys are sufficiently near to be readily distinguishable one from the other.

Should a sailing vessel be off Caermarthen bar, under circumstances that the risk would be greater in the endeavour to clear the bay than in attempting the entrance, then wait if possible until near high water, when, aided by the buoys (all of which are fairway buoys), make for Llansaint church on an E. $\frac{1}{2}$ S. bearing ; haul up from the No. 7 buoy for the white beacon off Warlo bluff, and pass eastward of it ; thence westward of the black beacon off Ferryside, and having passed it haul in close to the village and make fast to the quay.

TOWNS.—**Kidwelly** town, situated on the east side of the estuary of the Towy, is divided by the Gwendraeth-fach, which is crossed by a stone bridge. The railway, which from Ferryside skirts the shore, has a station one-third of a mile westward of the town. Burton quay is now disused, but small vessels can go up to it.

The population, which in 1881 numbered 2,510, are chiefly employed working coal and other minerals of the district.

Ferryside village on the Towy, 2 miles within the entrance, on the east bank, has good sands, and is much frequented by bathers in the summer season; the Great Western railway passes through it. A steam-vessel plies occasionally between Bristol and Ferryside, discharging at the quay, off which there is a depth of 18 feet at high-water springs. A boat ferry connects Ferryside with Llanstephan opposite.

A lifeboat is stationed at Ferryside.

Caermarthen is situated on a rising ground of 400 feet elevation, upon the right bank of Towy river. The church has a lofty square tower, and an obelisk to the westward, erected to General Sir Thomas Picton, is conspicuous. The river is crossed by a bridge of seven arches, and near it another on three pillars, over which runs the Cardigan railway. It is accessible to boats to Cistanog, about $3\frac{1}{4}$ miles above.

Caermarthen has a considerable general trade for the supply of an extensive district; small coasting craft come up to its quays, and a steam-vessel plies once a week between it and Bristol, but seldom comes above Blackpool stage, about three miles below, where there is 14 feet alongside at high water springs, as before stated. At high-water springs a vessel will carry up to Caermarthen quay, nearly 10 miles above the entrance, from 10 to 11 feet, and at neaps from 4 to 5 feet.

The town is connected with the South Wales railway by a short branch line, and from thence there is direct communication with the midland counties of England. The railway bridge, which crosses the river half a mile below the town, is opened on the approach of vessels.

The population of Caermarthen in 1881 was 10,514.

Laugharne village, on the Taf, is fully in view on passing within the mouth of the inlet; there is an extensive castle ruin on a rising foreground, and a church in the valley a little above. Coasters discharge under the cliff on the north side of the bight. The water is probably as deep off Laugharne as off Ferryside. Population in 1881, 1,627.

St. Clear's lies $4\frac{1}{2}$ miles above Laugharne; small coasters can reach it at high water; they discharge at a quay a little below the village, and about one mile from the railway station. The population in 1881 was 988.

BURRY INLET, on the east side of Caermarthen bay, and in which are situated the thriving ports of Llanelly and Burry port, is the most extensive estuary on the south coast of Wales. It is 4 miles wide at the entrance and about 9 miles deep to its head at Loughor, but the greater portion of the inlet is encumbered at low water by dry and shifting sands, with narrow channels and pools between (hereafter described), and its entrance by off-lying shoals.*

The northern side of the inlet is formed by the south extreme of the Pembrey burrows, named the Nose, within which are some dynamite works, the two chimneys of which are conspicuous; the south side is distinguished by Burry holm, 105 feet in height (p. 136), and the conspicuous hills within it, the Llanmadoc and Hardings Down, 596 feet and 487 feet in height respectively. The many tall chimneys in Burry inlet are conspicuous from the offing. Loughor river discharges into the head of the inlet, above Llanelly.

For light, directions, &c., see pp. 140–142.

BURRY PORT is situated on the north side of Burry inlet, about 4 miles within the North channel bar; this bar has 2 feet on it at low-water springs, 15 feet at half tide, 28 feet at high-water springs, and 22 feet at high-water neaps. South channel, though a longer route, has about 4 feet more water on its bar, and is generally used by vessels entering Burry inlet; sailing vessels, with northerly winds, use the North channel.

Within the bars the water deepens, there being from 3 to 5 fathoms in some of the pools at low water. From one mile below Burry port to the wet docks the channel dries from one to 3 feet at low water, with depths of 23 to 25 feet at high-water springs. The channels are buoyed.

Burry harbour and wet dock, is the property of the Burry port and Gwendraeth valley railway company, and has the advantage of being in immediate connection with the Gwendraeth and Trimsaran valleys, and the nearest port for shipping the anthracite coal, which is so extensively worked up those valleys.

The outer harbour, of about 15 acres, has a level bottom of blue clay. The pier is prolonged by a stone weir, marked at its south end by a post with barrel; a black buoy marks the east or opposite side of the entrance channel. In the harbour are several mooring buoys.

There are two wet docks with gates 45 feet in width; the eastern dock is $1\frac{1}{4}$ acres and the western 8 acres in area; there is a large reservoir for sluicing the channel outside. Every facility is afforded

* See Admiralty plan of Burry inlet, No. 1,167; scale, $m = 2\frac{1}{2}$ inches; also Chart No. 1,076.

for the despatch of shipping, ample steam crane and other power being available.

Vessels drawing 22 feet can enter the outer harbour during springs, and those of 20 feet the wet dock; there is a depth of about 15 feet over the sills of the latter during neaps, and 22 feet at ordinary spring tides. *See directions*, pp. 140–142.

Tidal light.—From the lighthouse, 18 feet in height, painted white with a black top, erected near the head of the west pier, is exhibited, at an elevation of 35 feet above high water, a *fixed white* light while there is 10 feet depth of water at the pier, and may be seen in clear weather from a distance of 9 miles.

Trade.—The principal exports are coal (about 60,000 tons), tin plates, copper, white-lead, fire bricks, and steel; and the imports, copper ore, pig-lead, pig-iron, steel blooms and bars, petroleum, &c.

The average number of vessels entering the port (1888) amounted to about 350, of the aggregate tonnage of 75,000 tons. Population about 2,000.

Pembrey old harbour, is about 4 cables westward of Burry port, and is formed principally by a western pier or quay wall, which extends in a southerly direction for 800 feet, having on its outer end a circular tower, which was formerly a lighthouse. The collieries in connection with this harbour have become inundated, but the latter has been improved, and is now used in connection with the dynamite works at the Nose, about $1\frac{1}{2}$ miles to the westward.

About three-quarters of a mile within the harbour is the village and church of Pembrey, the latter having a dark square tower with a white parapet wall. From the back of the village rise some well-wooded hills, elevated 356 feet. One-third of a mile eastward from the church is Pembrey house, a freestone building with wings, and an old engine chimney a little west of it.

Coastguard.—Pembrey is a coastguard station.

LLANELLY is about 8 miles by the channel within Burry holm, and about 3 miles above Burry port on the same side. Owing to the extensive and productive coal mines in its neighbourhood, the establishment of copper and iron works, and the excellence of its harbour and docks, it has been rendered one of the most flourishing towns of South Wales, and has profited by the recent construction of railways in different directions, especially into the centre of the rich north-east coal-fields.

The town is irregularly built on low ground, and intersected by the river Lliedy; it is about three-quarters of a mile from the inner

docks and Custom-house, and there are several conspicuous chimneys attached to the mineral works.

Harbour and wet docks.—The South channel to Llanelly harbour, by Burry holm, has the best water and is generally used. It has a depth of 6 feet on the bar at low-water springs, 32 at high-water springs, and 25 at high-water neaps; but the inner bar, abreast Whiteford point, 3 miles within, has 4 feet less water; the least water, however, is at and near the port, where the channel dries about one foot at low water, but has a depth of 25 feet at high-water springs, at which time there is about 22 feet on the Great Western wet dock sill. There are pools in the fairway where vessels may lie afloat in from 3 to 5 fathoms at low-water.

The harbour is formed by a breakwater projecting from the western shore in a southerly direction for three-quarters of a mile, and other breakwaters eastward of it, fitted with mooring rings. These afford excellent shelter to a fine flat of mud and sand, on which 50 to 60 vessels may lie aground without risk, and over which are depths from 10 to 15 feet at high water springs, but uncovered between half-ebb and half-flood. The channels through the flat to the several docks are kept clear by occasional sluicing from the reservoirs.

A training wall built with slag is in progress from Salthouse point, on the south side, with a view to the improvement of the channel to sea; it is intended to continue this wall to abreast Burry port.

Docks.—There are two wet docks and two tidal basins at Llanelly :—

Copper works wet dock is 700 feet in length, 31 feet wide in the entrance, with a depth of 17 feet in the dock, and 19 to 20 feet on the sill at high water springs. It is furnished with every requisite for loading and discharging vessels with despatch; there are hydraulic cranes on both sides, and it is connected by rail with the New dock.

A black ball is shown by day, and a light at night, when the gates cannot be opened; vessels must then bring up on the flat.

The Great Western railway company's wet dock is 600 feet in length, $31\frac{1}{2}$ feet wide in the entrance, with from 21 to 22 feet on the sill at high water springs, and about 18 feet in the dock; it has a powerful hydraulic crane and a commodious goods shed. The dock is situated at the terminus of the Llanelly Railway and Dock Company's line of railway from Llandovery, and the extensive anthracite districts of Cwmamman and Llandybie; it is also brought into immediate connection with the South Wales railway by a short broad

gauge branch. Besides coal of various kinds, including the smokeless or steam coal, there are factories for silver, copper, lead, tin, and iron; iron and wood shipbuilding yards, anchor, chain, and rope works.

Caermarthenshire tidal basin, the western one, is 600 feet in length, and has a smooth bottom upon which vessels lie dry at low water; it is available at spring tides for vessels of 16 feet draught, and at neaps for those of 8 feet. The east side of the basin is used for the discharge of general cargoes.

A patent slip, 380 feet in length, adjoins this tidal basin, capable of taking up vessels of 800 tons.

The Lead works, or Pemberton's tidal basin, has every convenience for loading and discharging; but, like the Caermarthen basin, dries.

Light.—A *fixed white* light, 36 feet in height, is shown from the south extreme of the west breakwater, from half flood to first quarter ebb, visible about 7 miles.

A storm signal cone is exhibited from the Copper Works dock.

Trade.—The exports and imports are similar to those from Burry port (p. 133). About 50 vessels, of the aggregate tonnage of 8,000, belong to the port; about 1,000 coasters and 250 foreign going vessels, of the aggregate tonnage of 350,000, enter and leave annually.

Population of Llanelly in 1881 numbered 27,779.

There is regular steam communication to and from Bristol and Liverpool.

Loughor or Llwchwr, a village with a population of about 2,700, and a railway station, lies at the head of Burry inlet, on the promontory which separates Loughor river from the Afon Lliw. The narrows, which separate it from Yspitty point on the Llanelly side, are about 300 yards wide, and crossed by railways and road bridges so constructed on piles as to allow formerly a passage for vessels, but which the shallow water will not now admit.

WORMS HEAD, situated southward of Burry inlet, though not properly its boundary, is its south-eastern approach, near to which vessels necessarily pass when bound in or out.

It is the north-west extremity of a narrow islet three-quarters of a mile in length, separated from Rhos-sili point by Worms sound, about $2\frac{1}{2}$ cables in breadth.

The island has three conspicuous hummocks; the outer one is 162 feet, and the inner 139 feet in height. On the north and west

sides it is steep-to, but to the southward it is foul to the distance of 2 cables.

Worms sound is dry at half tide, but it has a depth of 13 feet at high water springs, over rocky bottom, but no stranger should attempt it.

Danger reef, with 4 feet water on its extreme, extends about 6 cables southward of Rhos-sili point; foul ground extends the same distance southward of Worms head table-land.

Rhos-sili bay, between Worms head and Burry holm is $2\frac{1}{2}$ miles wide, with a low water sandy shore drying out about a quarter of a mile. The southern half of the coast is formed of limestone, with cliffs 100 feet high and much quarried, backed by steep falls from Rhos-sili downs; a conspicuous peak named High Barrow, elevated 595 feet, being a prominent sea-mark. At the southern foot of the slope from the beacon 620 feet in height, is the village and square towered church of Rhos-sili; and in the valley eastward of Burry holm, and of the Llangenydd burrows forming the northern coast of the bay, is that of Llangenydd with its church and steeple.

Coastguard.—A detachment of coastguard is stationed here.

Burry holm is the southern boundary of the entrance to Burry inlet. It is a grassy islet, about 400 yards in length, 200 yards in breadth, and 105 feet in height, with steep cliffs on the west end; on the east side it slopes to a sand and rocky spit, which at half-tide connects it with Limekiln point within. At its outer end the low-water rocky ledge dries but a short distance, and is connected with the sands on both sides.

Sand hills extend eastward up Burry inlet for some distance from Limekiln point, fronted by low cliffs.

Whiteford point.—At $3\frac{1}{2}$ miles within Burry holm is Whiteford point, and about mid-way the Spritsail Tor cliff, on the west side of which is Broughton bay, backed by sand hills; to the eastward of Spritsail Tor are the Whiteford burrows, which extend to Whiteford point. Within Spritsail Tor cliff is Llanmadoc hill, having on its smooth summit, nearly 600 feet in height, two cairns above half a mile apart.

In the bight between Whiteford and Salthouse points, a distance of 4 miles, are the Llandimore and Llanrhidian marshes, fronted by the Llanrhidian sands, which extend a distance of $3\frac{1}{2}$ miles, or nearly to Burry port. The Burry stream winds out between the quarried limestone cliff, through the marsh, within Whiteford point; its channel is marked by beacons for the convenience of the stone lighters, which here find good shelter.

Salthouse point is low, with a bed of loose stones projecting 2 cables from it ; Burry inlet is fordable between Salthouse point and Penrhynwgwm point on the opposite side, from one hour before to one hour after low-water springs.

Pen-clawdd village is situated upon the shore, about a mile above Salthouse point. There is a very small tidal basin here, and a jetty just above it, but the shallow depths admit of but little traffic. There are collieries, copper and tin works here, and also a branch of the North-Western railway.

There is a chapel, white and conspicuous, half-way up the west slope of the hill over the village.

SANDBANKS in Burry inlet.—As Burry inlet is nearly dry at low water, and the banks, especially about the entrance, are continually changing it is only desirable to give a general description of their extent and character according to the latest Admiralty survey, with the latest arrangement of the buoys which mark the best channels.*

Hooper and Lynch sands.—West Hooper dries 12 feet at low water, is separated from Pembrey sands by North channel, and projects in a west-south-west direction for about 2 miles. The Hooper and Lynch sands, about $2\frac{1}{2}$ miles in extent in an east and west direction, dry from 3 to 5 feet at low water springs, and nearly fill the space between West Hooper and Whiteford point, being separated from the latter by South channel. Between the eastern portion of the Hooper and the mussel bank extending from Whiteford point, is the Inner bar.

Middle sand.—The north extreme of this shifting sand, dry from 4 to 8 feet at low water, is within half a mile of Burry port, with the channel to Llanelly between them ; Middle and Llanrhidian sands occupy all the southern portion of the inlet, and in places only cover towards high water springs. The small streams or pills which intersect these sands at low water are crossed in several places by fishing weirs ; and an abundance of cockles give support to numerous families, and find a ready market in the larger towns of the Bristol channel.

Pools.—Westward of Middle sand there is a pool with from 4 to 5 fathoms at low water, about three-quarters of a mile in length ; there is also a similar pool northward of Middle sand.

* See Admiralty plan of Burry inlet, 1167, from Admiralty survey of 1886.

From about one mile below Llanelly, to the head of the inlet, it is all dry at low water springs; above Salthouse point the Bacas and Dafan sands fill the whole of it, there being a slight depression only between them, marked by beacons, which possibly admits small craft to Loughor at high water. A training wall is in progress from abreast Salthouse point, westward, with a view to improve the depths from Llanelly to seaward.

Whiteford Scar and sands, composed of loose stones and mussel-scar, project from Whiteford point to a distance of three-quarters of a mile, connecting with the Llanrhidian sands on the east, and with Whiteford sands on the west, the latter drying out from Whiteford burrows and Broughton bay, about one-third of a mile. *See light on Scar, p. 140.*

Foul ground, about three-quarters of a mile in extent, in an east and west direction, with depths of 3 to 5 fathoms, lie in the approach to South channel, at about 2 miles westward of Burry holm. Near its western extreme, a patch with 22 feet water is known as Hall rock; and near the east end are two heads with 18 feet water, from which the Holm summit bears E. by S. $\frac{1}{2}$ S., distant $1\frac{1}{10}$ miles.

Buoyage.—As the sands are liable to change, and the buoys to be shifted in accordance (though not always immediately), their positions are not herein given. They are numbered from seaward; No. 1 in South channel is about $1\frac{1}{2}$ miles within the outer bar, abreast Broughton bay; No. 1 in North channel lies just within its bar. The buoys are placed close enough together to be easily seen from one another.

South channel buoys are black, and black and white; North channel buoys are red, and red and white, with the exception of the black buoy between Nos. 5 and 6 red buoys.

The Swashway between South and North channels, eastward of West Hooper, is marked by one black buoy on its eastern side.

Buoys painted in one colour are to be left on the starboard hand on entering.

SOUTH CHANNEL.—The channels up Burry inlet are formed by long and narrow pools, to which there are two recommended entrances from seaward over the outer shallows or bars. The Southern, about 8 miles below Llanelly, is the deeper of the two, and that generally used; it leads half a mile northward of Burry holm, and along Whiteford sand; thence towards Llanelly.

Over South channel outer bar and between the several deeps or pools, not less than 19 feet water will be found at half tide, 25 feet at high water neaps, and 32 feet at high water springs, as far as

No. 3 buoy, or nearly abreast Whiteford point ; here is the inner bar with about 4 feet less water than the outer bar ; above it the water deepens to about 26 feet at half tide, until within about one mile of Llanelly, whence there is about 13 feet water at half tide, and with but little variation to the harbour and dock entrances ; the wet dock sill, as before stated, has 23 feet at high water springs, and 16 feet at high water neaps. *See* buoyage, p. 138.

North channel is formed between Pembrey and West Hooper sands, and is locally known as the Gwtter Goch. The bar, situated 4 miles below Burry port, has 16 feet at half tide, 22 feet at high water neaps, and 29 feet at high water springs. Within the bar the water is much deeper to within one mile of Burry port, whence there is about 4 feet less water than on the bar ; the wet dock sill has 22 feet water at high water springs, and 15 feet at high water neaps.

The Swashway, through the sands, close eastward of West Hooper sands, has a depth of about 22 feet at half tide, and is used by sailing vessels when the wind does not admit of their laying through South channel.

Loughor river is navigable at high water for vessels of light draught as far as Loughor, Yspitty, and Llangennech quays.

ANCHORAGES.—Vessels waiting for tide to admit them to Burry inlet, or for a pilot, will find temporary anchorage in Rhos-sili bay, southward of Burry holm. A good position in southerly winds is under Worms head, in about 3 fathoms, over stiff mud, with the head bearing W. by S., and Rhos-sili point S.E. by S. ; it is out of the stream of tide and sheltered, provided there is no northing in the wind. Large vessels should anchor in 5 fathoms with Worms head S.W. by S. about one mile. No vessel should venture to remain in this bay on the approach of bad weather from westward, as before there is much wind it is subject to heavy rollers.

If hovering about, keep Pembrey church shut in with Burry holm, to avoid the strength of the tide.

South channel.—Besides Rhos-sili bay, there are several anchorages in the pools in Burry inlet for coasting vessels.

The holding ground is good, but during northerly or westerly winds there is a considerable sea in the outer ones.

Above Whiteford lighthouse, in the South channel, anchorage will be found above No. 4 buoy in 4 to 5 fathoms. The holding ground is good, but in strong westerly winds there is, when the banks are

covered, a heavy sea, to which a vessel during the strength of the tide lies broadside on.

East pool, between Burry port and Llanelly, between Nos. 5 and 8 buoys, has depths of $2\frac{1}{2}$ to 4 fathoms, and is from one to half a cable in width, but as the banks are constantly shifting, its limits are not to be depended on.

North channel.—Pembrey pool, in the north channel, between Nos. 3 and 4 buoys, is a good temporary anchorage with a depth of 2 to 5 fathoms.

LIGHTS.—On about the centre of Whiteford Scar, 4 cables N. $\frac{3}{4}$ W. from the point, stands an iron lighthouse, 63 feet high, from which is exhibited from half flood to half ebb, at an elevation of 55 feet, a *fixed white* light, visible between the bearings of N.E. by N., through east, and south, to N.W. by W. $\frac{1}{2}$ W., approximately.

For tidal lights at Burry port and Llanelly, *see* pp. 133, 135.

Danger signal.—When it is considered dangerous to cross the bar, a drum is hoisted at Whiteford lighthouse during the above time of tide.

Pilots and Steam-tugs.—Pilots for Burry inlet are licensed, and cruise in three cutters, painted black, with the letter L and their numbers painted upon their bows and mainsails. During moderate weather the pilot vessels cruise about in Caermarthen bay; when rough, they will be found in Caldy road or Rhos-sili bay. Vessels should not attempt to pass above Whitford light without one. Four steam tugs are in constant attendance for either port, the signal for one being the ensign tied at the head.

Lifeboat.—A lifeboat is stationed on the east pier at Burry port.

Tides.—It is high water, full and change, at Whiteford lighthouse, Burry inlet, at 6h. 4m. local, or 6h. 21m. Greenwich time; equinoctial tides rise 28 feet, ordinary springs 26 feet, and neaps $19\frac{1}{4}$ feet. At Burry port and Llanelly it occurs respectively 5 and 15 minutes later. The rate of the flood on springs is 3 knots, but the ebb, aided by freshets, is sometimes 4 knots; while neaps average 2 and 3 knots. The flood stream sets fairly over the bar, but until the banks are covered, its direction is guided by the channels between them, and after they are covered, which occurs from one-third to half flood, it is necessary to guard against a southerly set towards Burry pill and Llanrhidian sands, and that in the contrary direction on the ebb.

DIRECTIONS.—The first high land made by vessels from the westward bound for Burry inlet is Rhos-sili hill; under it is Worms

head, resembling three islets, and about 3 miles northward of the head will be seen Burry-holm, at the entrance to the inlet. If running up channel in unfavourable weather, it would be well to pass close to Caldy island, and from thence obtain a pilot, as at times there is much risk transferring them from an open boat. If unable to procure one, and it is blowing hard in with a heavy sea, it would be advisable to seek anchorage in Caldy sound, or to run for Mumbles road, 30 miles above Caldy.

The South channel is generally used by steam vessels, and, except during northerly winds, by sailing vessels. As before stated there is a depth of 19 feet over South channel bar at half tide, with 4 feet less on the inner bar 3 miles above it, deepening again within.

In moderate weather the entrance to Burry inlet may be approached from the westward, with the high cairn of Llanmadoc hill, open northward of Burry holm; and, whilst waiting for a pilot or the tide, all dangers will be avoided so long as Worms head bears eastward of S. by E. $\frac{1}{2}$ E. Strangers should not proceed above Whitford light without a pilot.

From the south-eastward, vessels should pass southward and westward of the Helwick light-vessel, but Rhos-sili parsonage open westward of the table land of Worms head, bearing E. by N. $\frac{1}{4}$ N., leads westward of the Helwick sands. From near the light-vessel steer to the north-eastward, and by keeping Worms head eastward of S. by E. $\frac{1}{2}$ E., until the bar leading mark comes on, all danger will be avoided.

The leading mark over the bar, and into Lynch pool, is Mount Hermon chapel in line with Sprintsail Tor, bearing E. by S.; thence the course is from buoy to buoy, leaving them on the starboard hand.

At No. 3 buoy the inner bar commences, thence pass close to the warning buoy, and on either side of No. 4 buoy; remembering the precaution necessary to counteract the set of the flood southward, across the channel; the remainder of the buoys are starboard hand buoys, to Burry port or Llanelly.

At night, vessels can only enter Burry inlet with the assistance of a pilot.

North channel.—With northerly winds, a sailing vessel taking the North channel will have the advantage of standing over the bar and through the channel in one tack; there is a depth of 15 feet at half tide on the bar, with deeper water within. The bar may be crossed with No. 1 and No. 2 buoys in line; thence to Burry port the fairway is close northward of all the buoys.

If proceeding to Llanelly, from No. 6 red buoy off Burry port, a vessel may cross the bank between it and No. 6 black buoy in the channel to Llanelly with 9 feet at half tide ; but if there is not sufficient water by that route, a vessel must take the swashway eastward of West Hooper sand, which has 22 feet at half tide. Having passed close northward of No. 4 red buoy, steer about S.S.E. through the swashway, allowing for tide, passing westward of the black buoy marking its eastern side, thence on either side of No. 4 buoy in South channel, thence northward of all the black buoys to Llanelly.

CHAPTER V.

BRISTOL CHANNEL.—WORMS HEAD TO CARDIFF.

VARIATION in 1891.

Worms head - - 19° 25' W. | Nash point - - 18° 50' W.

HELWICK SANDS, situated southward of Worms head, are within a depth of 5 fathoms, $6\frac{1}{4}$ miles in length, in an E. by S. $\frac{1}{2}$ S. and opposite direction, by a quarter of a mile in breadth, and are steep-to. Their eastern extreme is less than half a mile from Porth Eynon head, with Helwick pass between, and there is a swashway between the east and west Helwicks.* On the south side of the sands the depths decrease rapidly from 12 or 14 fathoms to 2 to 3 fathoms on the banks; on the north side they are not so steep, and from the westward the shoaling is gradual.

West Helwick sand, within a depth of 3 fathoms, is $1\frac{1}{2}$ miles in length, with a least depth of 2 fathoms near its centre, with High Barrow peak seen through the middle of Worms sound.

Helwick swash, between the east and west sands, is about $1\frac{1}{2}$ miles in width, with a depth of $3\frac{1}{4}$ fathoms at low water.

East Helwick sand has a least depth of 13 feet, and within the depth of three fathoms it is $1\frac{3}{4}$ miles in length; there is but little better water to its eastern extreme, one mile beyond that depth.

In Helwick pass, the east entrance to the channel within the sands, there is from 5 to 6 fathoms water; this channel is advantageous for coasting craft, as towards low water it offers comparatively smooth water, with both northerly and southerly winds. For these vessels the east Helwick buoy may be considered as in the fairway, and may be passed on either side.

Buoys.—West Helwick sand is marked by a red and white horizontally-striped spherical buoy, with staff and diamond, in 8 fathoms, at one mile N.W. by W. of the depth of 3 fathoms, with Worms head bearing E.N.E. distant $3\frac{3}{10}$ miles.

* See Admiralty charts, St. Goven's head to the Mumbles, No. 1,076; scale, $m = 1\cdot25$ inches; and Bristol channel, No. 1,179; scale, $m = 0\cdot5$ of an inch.

A red and white vertically-striped can buoy, in about 6 fathoms, marks the south side of the centre of the swashway, with Burry holm seen midway through Worms sound, bearing N. by E. $\frac{3}{4}$ E; this line leads through.

A red and white horizontally-striped spherical buoy, in about 4 fathoms, lies near the east extreme of the Helwick sands, about one cable within the depth of 5 fathoms, and about half a mile S.W. $\frac{1}{4}$ W. from Porth Eynon head.

HELWICK LIGHT-VESSEL lies in 17 fathoms about 2 miles westward of west Helwick sand, with Worms head bearing N.E. by E. $\frac{3}{4}$ E. distant $4\frac{6}{10}$ miles, and Scarweather light-vessel S.E. by E. $\frac{1}{2}$ E. $18\frac{1}{2}$ miles.

From the vessel is exhibited, at an elevation of 36 feet above the sea, a *flashing white* light, showing one flash every thirty seconds, and visible in clear weather from a distance of 11 miles. The vessel is painted red, with the word *Helwick* on her sides, and carries a ball at the masthead. A gun is fired if a vessel is seen standing into danger.

Fog signal.—The powerful fog siren established on board the Helwick light-vessel will, during thick or foggy weather, sound blasts of *five seconds* duration at intervals of *two minutes*.

Tides.—The flood tide from Worms head to Porth Eynon sets across the Helwick sands, but the ebb sets fairly along the channel; the velocity is from $1\frac{1}{2}$ to 3 knots.

Directions.—No vessel should approach the Helwick sands from the southward into a less depth than 13 fathoms, not only on account of their steepness in that direction, but also because within that depth there is a heavy cross-sea during the ebb stream in strong westerly winds. A good mark for leading southward of the Helwicks is, Pwll-du head well open of Oxwich head bearing E. $\frac{1}{8}$ S. In clear weather, the Mumbles open of Oxwich head bearing E. $\frac{1}{2}$ S. (view B, chart 1076), and (view F, chart 1179), also leads southward, but closer to the sands.

Rhos-sili parsonage only just open eastward of Worms table-land, bearing E. by N. $\frac{3}{4}$ N., leads over the west end of the sands in 28 feet (view A, chart 1076). The parsonage seen westward of the table-land leads well westward of the sands.

In thick weather, while working to the southward of the shoals, with a carefully-hove lead, the sudden decrease of the depth, and the alteration in the character of the bottom from gravel and stones to fine sand, will afford sufficient warning to vessels to stand off in time.

In proceeding eastward from the Helwick sands, with a general offing of $1\frac{1}{2}$ miles from the headlands, 17 fathoms over gravel will be found off Porth Eynon head ; 14 fathoms over gravel off Pwll-du head, and 9 to 12 fathoms over a similar bottom when approaching the Mumbles.

From the westward through Helwick pass, bring Porth Eynon head to bear E.S.E., and steer for it, until nearly abreast Slades bluff, then steer to pass just eastward of east Helwick buoy. If working through, Porth Eynon head must not be brought to bear eastward of E. by S. $\frac{1}{2}$ S. (with Oxwich head just shut in), until nearly abreast the east end of east Helwick sand ; thence the east buoy may be brought to bear as far to the eastward as S.E. by E. $\frac{1}{2}$ E.

By night, while passing along the south side of Helwick sands, do not bring the light-vessel to the westward of W.N.W. until the Mumbles light is northward of East.

PORTH EYNON HEAD.—The coast from Rhos-sili point trends in a south-easterly direction for 4 miles to Porth Eynon head, and eastward of Tears point consists of rugged, broken, and nearly perpendicular cliffs from 100 to 200 feet high, from which low-water rocks extend about the distance of one cable as far as Slades bluff, with a depth of 3 fathoms over clean ground at 3 cables from the shore. Porth Eynon head is 141 feet high, with an abrupt fall to the sea ; the rocky foreshore dries to the distance of 2 cables south-west from the head, with from 3 to 5 fathoms close-to, whilst to the eastward the ledge dries one-third of a mile, and on which stand the low islets named Skysea and Sandy ; shallow water extends 2 cables south-eastward of this portion of the ledge, and there are rocky patches of $3\frac{1}{2}$ fathoms at 9 cables south-eastward of the head. On the west side of the head is a remarkable cave, named Culver hole.

Porth Eynon bay, eastward of the head, is fronted by a broad sandy strand, which dries out about 3 cables at low water ; the points of the bay are fringed with rocks, and to the eastward of Oxwich head ledges dry off about 2 cables at low water. A patch of $2\frac{1}{2}$ fathoms lies near the centre of the bay, with the church bearing N.W. $\frac{3}{4}$ W. $1\frac{2}{10}$ miles.

With off-shore winds, small vessels will find anchorage in 4 fathoms, good holding ground, with the church belfry N.W. and Skysea islet W. $\frac{1}{4}$ N. Care must be taken not to round the head within the distance of half a mile.

The village lies near the head of the bay on low and flat land, with Horton village eastward of it.

A **Lifeboat** is stationed here.

OXWICH HEAD AND BAY.—Oxwich head separates Porth Eynon from Oxwich bay. This bluff head is 235 feet in height; at the foot of its northern slope is Oxwich church and parsonage; and farther north will be seen the steeple of Penrice church, and a castle in ruins, with the high land of Cefn-y-Bryn eastward of them; the latter, from the eastward, has the appearance of a cone. Sandy burrows form the head of the bay, and a hard sand dries off one-third of a mile.

Sir Christopher's knoll lies about 7 cables off the north-east side of the bay, with a depth of $1\frac{1}{4}$ fathoms, rock, on its extreme, from which Pwll-du head bears E. by S. distant $1\frac{1}{2}$ miles.

Anchorage.—There is a good anchorage, with winds from the westward and northward, in $3\frac{1}{2}$ fathoms, with the extreme of Oxwich head bearing S.W. by W. distant 6 to 7 cables, and the boat-house N.W. $\frac{1}{2}$ W.

On the eastern side of the bay is Pennard pill, which dries at half-tide, where very small vessels can find shelter in easterly winds.

Mumbles lighthouse open, leads southward of Christopher's knoll, and the summit of Cefn-y-bryn open westward of, or in line with Little Tor, leads westward of it. Oxwich head should be given a berth of half a mile.

Coastguard.—A detachment of coastguard is stationed in Oxwich bay.

The coast to Pwll-du head, the eastern extremity of Oxwich bay, consists of broken cliffs from 200 to 250 feet in height, skirted by ledges dry at low water to the distance of 2 cables in places.*

Pwll-du head, elevated 298 feet, and steep-to, is a bold and overhanging bluff, within which is the village of High Pennard; westward of the head, about two-thirds of a mile, are two large caverns named Bacon and Minchen holes, known as the remarkable bone caves of Gower.

From Pwll-du head to the Mumbles, a distance of $3\frac{1}{2}$ miles, there is the same general character of coast feature, as before described, broken by three shallow bays, named Pwll-du, Caswell, and Longland; near Pwll-du, and also within Mumbles point, are extensive limestone quarries. Longland is encumbered with rocks, but in either of the other bays there is landing for boats. Thistle bluff, elevated 209 feet, is nearly one mile westward of Mumbles lighthouse.

SWANSEA BAY, between Mumbles head and Scar point, is about 9 miles across; the general character of its coast eastward of

* See Admiralty plan of Swansea bay, No. 1,161; scale, $m = 3.2$ inches.

Swansea being sandy burrows. Its western portion, Mumbles road, p. 153, affords shelter to small vessels with winds from westward of S.W., or whilst waiting for tide to enter Swansea docks.

Three considerable rivers discharge into the bay, viz., the Tawe, the Neath, and the Avan, and the shores are skirted by an extensive low-water flat, the margin of which is chiefly mud. Shallows extend beyond this for some distance, the 5-fathom line being $2\frac{1}{2}$ miles distant from the head of the bay. The bay, and its approach from the westward, is obstructed by the White Oyster ledge, Mixon shoal, and the Green grounds; and from the eastward by the Kenfig patches, Hugo bank, and Scarweather sands.*

MUMBLES HEAD. about 60 feet in height, and on which there is a battery, is the outer of two islets off Knaves, or Mumbles point, the islet between being named Middle isle; they are connected by a shingle causeway, which covers at half-flood.

Ledges.—From the outer islet, a rocky ledge dries south-eastward to the distance of one cable, terminating in a detached mass, named the Cherrystone, and which dries 4 feet at low water spring tides. In the same direction, one cable beyond, is a rock with 3 fathoms over it. Shelving ledges dry off to the distance of $1\frac{1}{2}$ cables south-westward of the islets, and off Tut head.

The southernmost house at high Pennard, in Pwll-du bay, open of Thistle bluff, leads southward of these rocks, and over the north end of Mixon shoal in not less than 15 feet.

LIGHT.—**Mumbles lighthouse**, 56 feet in height, erected on the summit of the outer islet, is white and octagonal, and exhibits, at an elevation of 114 feet above high water, a *fixed white light*, visible from a distance of 15 miles in clear weather.

Signal station.—There is a telegraph ship-signal station on the islet, in connection with the Swansea harbour office and the telegraph system of the United Kingdom, by which masters of vessels can communicate with their owners.

Coastguard and Lifeboat.—There is a coastguard watchhouse and flagstaff, with a life-saving apparatus, on the cliff, about 4 cables within Mumbles point, and a lifeboat on the shore eastward of it. This is the head-quarters of the division of coastguard in the district.

Mumbles village.—The coast from Mumbles head trends north-westward for about a mile, forming Mumbles road, thence

* See Admiralty plan of Swansea bay, No. 1,161; scale, $m = 3.2$ inches.

north-eastward for $3\frac{1}{2}$ miles to Swansea harbour; close eastward of the harbour is Kilvey old mill, a conspicuous mark, on an elevation of 620 feet.

The village of Oystermouth and Mumbles, with its church within the head, is situated on the shore at the foot of the steep cliffs, the summits of which are above 200 feet in height. Near the north end of the village, is the extensive ruin of Oystermouth castle, 170 feet above high water, and a prominent sea mark.

The village of Mumbles is connected by a tramway with Swansea, and is much frequented as a bathing place; it is the home of the oyster fishermen of the neighbourhood, whose boats number about 120; the population, included in the parish of Oystermouth, amounted in 1881 to 3,915.

Shore flats.—For about half a mile within the lighthouse, the low water shore of shingle does not dry out beyond the distance of a cable, but from thence to Swansea the flats extend about three-quarters of a mile off, and are chiefly composed of sand with patches of stone and mussel, with fishing weirs stretching along the greater part of the distance. Off Mumbles village there is a good layerage of mud over clay, well adapted for the grounding of vessels. For anchorage off, *see* p. 153.

SHOALS in the approach.—**Mixon shoal**, situated southward of the Mumbles, is composed of fine sand about 8 cables in extent in a north-east and south-westerly direction, by 2 cables in breadth, with two shallow ridges on its south-east side having from $1\frac{1}{2}$ to 6 feet water only. The shallow spot of $1\frac{1}{2}$ feet lies with Mumbles lighthouse bearing N.N.E. distant 4 cables; and the west extreme of the 6-feet ridge with the lighthouse N.E. distant 7 cables. On its north and western sides the water deepens gradually, and there is a narrow channel with 3 fathoms water between the shoal and the Mumbles; the south-east side of Mixon shoal is steep-to, there being 10 fathoms within one cable of it. The flood tide sets directly over the shoal.

Buoy.—A bell buoy, painted in black and white vertical stripes, in 10 fathoms, marks the southern elbow of Mixon shoal, with port Eynon and Oxwich heads in line, and Mumbles lighthouse N.E. $\frac{3}{4}$ N., distant 8 cables.

The Green grounds are detached patches of rock, and stones with oysters, extending over the greater portion of the west side of Swansea bay; they are divided by a channel half a mile wide in a W.S.W. and E.N.E. direction, with from 4 to 8 fathoms at low water.

The inner Green grounds lie within the 5-fathoms line fronting the shore of the bay; its west extreme lies about three-quarters of a mile E. by N. from the lighthouse; and thence extends one mile eastward, having from 7 to 10 feet over the several heads.

About three-quarters of a mile S. by W. $\frac{1}{2}$ W. from east Green grounds buoy are the two northern heads of the outer Green grounds, having a depth of $2\frac{1}{4}$ fathoms; thence they extend southward for $1\frac{1}{4}$ miles, and are about the same distance in breadth east and west, with depths from $3\frac{1}{4}$ to 5 fathoms, interspersed with depths of 6 to 8 fathoms.

Buoys.—Two buoys mark the southern edge; the south-western is a black and white chequered can buoy, in 4 fathoms, with Thistle bluff summit in line with south extreme of the Mumbles, bearing W. $\frac{3}{4}$ N., and Kilvey old mill N.E. $\frac{3}{4}$ N. The eastern buoy is a black and white vertical striped can buoy in $3\frac{1}{4}$ fathoms, with Mumbles lighthouse bearing W. $\frac{5}{8}$ S., and Kilvey old mill N.N.E. $\frac{1}{4}$ E.

White Oyster ledge.—In the offing, S.W. by S., $2\frac{1}{4}$ miles from Mumbles lighthouse, is a patch of foul ground having not less than $4\frac{1}{2}$ fathoms over it; but upon which a heavy sea breaks when the ebb stream is opposed by a strong westerly wind, and is therefore to be avoided. The ledge within a depth of 6 fathoms is 6 cables in extent, surrounded by depths of from 7 to 10 fathoms, on a bed extending 2 miles in a north and south direction by one mile east and west; sounding on this bank may assist a vessel in foggy weather to identify her position off the Mumbles.

Buoy.—A spherical buoy, with black and white horizontal stripes, lies in 8 fathoms one cable southward of the $4\frac{1}{2}$ fathom head of White Oyster ledge.

SCARWEATHER SANDS are situated in the southern approach to Swansea bay; its western extreme of 3 fathoms lies with Porthcawl lighthouse bearing E.S.E. distant $7\frac{8}{10}$ miles; from this extreme the bank extends in the direction of that lighthouse. Within the depth of 3 fathoms it is $4\frac{1}{2}$ miles in length, by nearly three-quarters of a mile (about the centre) in width. The bank dries into separate patches; viz., West Scarweather, the principal, and lying near the centre, is about one mile in extent in an east and west direction, and dries 6 feet at low-water springs, with several patches awash extending half a mile westward of it. East and Middle Scarweather, towards the eastern end, are small patches which dry only at low-water springs. The nature of the bottom immediately surrounding the bank is mostly fine sand, except near the north-east end, where it is mixed

with stones, and a ridge of 4 fathoms connects this bank with the foul ground within. A heavy sea is generally breaking over the Scarweather in bad weather, and it is rendered more dangerous from the oblique set of the tide across it.

Clearing marks.—Worms head, open of Porth Eynon head, leads southward of the Scarweather; the Mumbles, bearing N. $\frac{1}{2}$ E., leads westward; and Kenfig church, in line with Scarhouse, leads eastward. (View A, chart 1183.) Porthcawl light, showing *white*, also leads southward of the Scarweather.

LIGHT-VESSEL.—The Scarweather light-vessel is moored in 14 fathoms, S.W. $1\frac{1}{2}$ miles from West Scarweather buoy, with Nash point bearing S.E. by E. $\frac{1}{4}$ E., $14\frac{1}{2}$ miles; and Mumbles lighthouse, N. $\frac{3}{4}$ E. $7\frac{1}{4}$ miles. The light is a *quick-flashing white* light, showing *one flash every five seconds*, at an elevation of 38 feet, and may be seen in clear weather from a distance of 10 miles. By day the vessel, painted red, is distinguished by having a half globe over a globe at the masthead, with the word *Scarweather* on her sides.*

Fog signal.—The fog siren is sounded during thick and foggy weather, giving *two* blasts in quick succession *every two minutes*.

Buoys.—The Scarweather is marked by three buoys; West Scarweather is a spherical buoy, painted in red and white horizontal stripes, surmounted by a staff and diamond; it lies in 5 fathoms, about 3 cables West of the extreme of 3 fathoms, with the light-vessel bearing S.W. distant $1\frac{1}{2}$ miles.

East Scarweather is a spherical buoy painted in red and white horizontal stripes, surmounted by a staff and triangle; it lies 3 cables S.E. of the east extreme of the 3 fathoms edge, in 7 fathoms water, with Porthcawl lighthouse E. by S. $\frac{1}{4}$ S. distant $2\frac{3}{4}$ miles.

On the north side of the sands is a black conical buoy in $5\frac{1}{2}$ fathoms, with the East Scarweather buoy bearing S.E. distant $1\frac{3}{4}$ miles.

Hugo bank, from a half to one mile northward of the Scarweather, in form resembles the letter V, and extends in the directions N.W. by W. and N.N.W., $1\frac{1}{4}$ miles on each; the shallowest part, from 2 to 6 feet, is about 3 cables in extent, and lies about one cable within the centre of its southern edge.

Buoy.—A black and white chequered can buoy in $4\frac{1}{2}$ fathoms, lies $1\frac{1}{2}$ cables S.S.W. of the west extreme of the less than 6 feet portion of Hugo bank, with North Scarweather buoy bearing S.W. $\frac{1}{4}$ W. distant 4 cables.

* See also Admiralty chart, No. 1,183.

Shord channel is about 4 cables in breadth between the Scarweather and Hugo sands, with a least depth of $4\frac{1}{2}$ fathoms on the ridge joining the Scarweather with the foul ground extending from Scar point. The course through from Fairy rock buoy off Porthcawl, is N.W. $\frac{1}{2}$ W., passing northward of east and north Scarweather buoys. The north slope of Ogmores downs in line with Rhwchiwns farm bearing E. by S. $\frac{3}{4}$ S., also leads between Scarweather sands and Hugo bank.

From abreast Rhwchiwns point, the tidal stream sets westward through Shord channel from about two-thirds ebb until one-third flood stream; the eastern stream from one-third flood until two-thirds ebb.

Kenfig and North Kenfig patches lie between Hugo bank and the coast, and are mostly of rock, with depths of 2 to 3 fathoms over them. North Kenfig has one patch of 10 feet, lying $1\frac{1}{6}$ miles W.N.W. from the south entrance point to Kenfig pill; and upon the same bearing, $3\frac{1}{2}$ miles distant from the point, are gravel patches of 4 fathoms. The space between the Kenfig patches and the coast is foul, with rocky heads in places of 2 to 3 fathoms; and off Rhwchiwns farm, at 4 cables south-west from the point near which it stands, there is a patch of 6 feet.

Buoy.—A black conical buoy, in about 4 fathoms, marks the south-east extreme of the largest of the Kenfig patches, one mile in length, with depths of $2\frac{1}{2}$ to 3 fathoms, and situated just northward of the Hugo; the buoy lies E. by N. $\frac{1}{4}$ N. distant $1\frac{2}{6}$ miles from Hugo bank buoy, with Scar house bearing E. $\frac{3}{4}$ S.

Tides.—It is high water full and change, at the Mumbles at 6h. 1m. local; or 6h. 17m. Greenwich time. Equinoctial springs rise 31 feet, ordinary springs $27\frac{1}{2}$ feet, and neaps $20\frac{1}{2}$ feet.

In the fairway between the Mumbles and the Scarweather the flood sets to the eastward from low water until one hour before high water by the shore, at the rate of from 3 to 4 knots an hour at springs, and 2 to 3 knots at neaps. In the parallel of the Scarweather and southward of it, the flood sets in a more south-easterly direction after half flood, or obliquely across the bank, and towards the west Nash about S.S.E., turning there at high water by the shore; from the Mumbles to Swansea and Neath, the flood and ebb run directly to and from those places. There is but little slack water, and the ebb stream runs for 7 hours to the westward.

Near the shore of Swansea bay, from half-flood until low water, an eddy sets round the bay from the eastward. The ebb with a

velocity of 3 to 4 knots at springs, sweeps southward, close past Mumble head, off which there is at times a strong race; at half a mile outside it turns gradually round to the westward in the direction of the coast, and closer in becoming influenced by Porth Eynon and Oxwich heads.

Pilots and steam-tugs.—Pilots are always to be obtained off the Mixture or within Mumbles head, and no vessel about to enter the docks must run for Swansea without one. They cruise in vessels of both schooner and cutter rig, with the letter S and number on their sails; and at night show a flash light when necessary. Steam-tugs will be found in attendance in the bay from half-flood to half-ebb.

Pilotage, outwards, is not compulsory, and the Harbour Trustees have made application to abolish compulsory pilotage, inwards.

DIRECTIONS.—From the westward.—Vessels approaching Swansea from the westward, and not wishing to anchor, should so regulate their speed as to be off the entrance to the harbour and docks between half flood and high water; pilots, as before stated, will be found in the neighbourhood of the Mumbles. Approaching southward of Mixture shoal, keep Porth Eynon head open of Oxwich head, bearing W. $\frac{7}{8}$ N., which leads southward of Mixture bell buoy; when Sketty church spire is well open of Mumbles head lighthouse bearing N. $\frac{3}{4}$ E., steer to pass southward of Inner Green Grounds buoys, anchoring in the outer road if necessary; or if about to enter Swansea harbour, from abreast the north-east Green Grounds buoy, edge to the westward to bring Kilvey mill in line with Lambert's chimney, which will lead up to the entrance channel.

Vessels may also proceed westward of the Green grounds, but as the vessel will be in charge of the pilot, no further directions are necessary.

If of light draught, and bound only to Mumbles road; when Oystermouth castle opens of the Mumbles lighthouse, steer N.N.W. until Mumbles church bears N.W. by W., then steer for it, anchoring when the lighthouse keeper's chimneys come in line, in about 14 feet, as directed p. 153.

Light draught, or others when tide permits, may pass within Mixture shoal by keeping the southernmost house at high Pennard in Pwll-du bay open of Thistle bluff, in not less than 15 feet at low water; when Oystermouth castle opens proceed as before, either for Swansea or Mumbles road.

In thick weather the approach to Mixture shoal may be known in the same way as that to the Helwicks, viz., by a deep water track of

course ground shoaling up to the fine sandy edge of the shoal. Vessels should not approach the land to a less depth than 10 fathoms at low water until assured of their position.

At night no vessel should pass inside the Mixture ; bearings of the Mumbles and Scarweather lights will give the vessel's position ; and when Swansea harbour lights bear N.E. by N., the outer road may be steered for, and anchorage taken when Mumbles light bears W.N.W., or having obtained a pilot, course steered for the docks if the gates are open.

From the eastward.—Approaching Swansea from the eastward, vessels from abreast the Nash will shape course to pass well southward of the Nash sand buoys, thence to Scarweather light-vessel, observing (in clear weather), that Worms head open of Porth Eynon head leads southward of Scarweather sand, midway between it and the light-vessel ; from abreast the light-vessel steer about N. by E. $\frac{1}{2}$ E., allowing for tide, for Swansea.

At night.—From abreast Nash lights, steer to pass about one mile southward of the Scarweather light-vessel, observing that the eastern Nash light must not be opened northward of the western one until approaching the Scarweather light-vessel, to avoid Nash sands ; from abreast the Scarweather, steer midway between Mumbles and Swansea lights to the anchorage or docks.

ANCHORAGES.—Mumbles road.—The inner anchorage in about 14 feet, for vessels drawing about 10 feet water, is with the chimneys of the lightkeepers' house in line bearing S. by W $\frac{1}{2}$ W., and Oystermouth (All Saints) church N.W. by W. ; the holding ground is stiff mud, and there is shelter with off-shore winds from south-west round to north.

A heavy ground swell sets into Mumbles road with winds from the south and east, and also when blowing hard from the westward, which, however, goes down considerably with the falling tide. Should a vessel have lost her anchors, she may safely run upon the mud abreast Mumbles village.

The outer road lies about one mile south-east of the lighthouse with depths of $5\frac{1}{2}$ to 8 fathoms. A good position in about 8 fathoms, is 2 cables southward of the western Green grounds buoy, with Kilvey old mill just open eastward of Swansea east pier light, N.E. $\frac{3}{4}$ N. and Mumbles light W.N.W.

RIVER TAWE rises in the Black mountains of Brecknockshire, near the source of the Usk. It has a source of about 25 miles in a south-west direction, and after entering Glamorganshire and receiving

several tributaries, it flows through a broad and rich valley of minerals, and joins the sea at Swansea.

SWANSEA HARBOUR AND DOCKS.—The corporate and parliamentary borough of Swansea, situated along the west bank of the Tawe, is a populous and flourishing seaport; its churches and tall chimneys are conspicuous from the bay, though at times obscured by the dense smoke from the numerous works.

The harbour.—The mouth of the Tawe, which forms the harbour of Swansea, is confined between wooden piers filled in with rubble; the western pier extending southward with a slight eastern curve is about 1,800 feet in length, and the eastern projecting from the tidal basin to Prince of Wales dock, is 1,140 feet, the entrance channel between them is 440 feet wide; this entrance is being dredged to a depth of 12 feet at low water springs, which will give 26 feet at half tide, 32 feet at high water neaps, and 39 feet at high water springs. The depth on the Prince of Wales dock sill is 32 feet, South dock 24 feet, and North dock 23 feet at high water springs, and 7 feet less at high water neaps. The entrance of the Prince of Wales dock is 60 feet wide, and therefore capable of taking the largest vessels of the mercantile marine.

The New cut, or lower part of the river, is about 200 feet wide and partially wharved; it is crossed by three railway and other bridges adapted for the passage of vessels, and is navigable for those of light draught for about 2 miles up. Abreast the north end of the North dock there is a depth in the river of about 19 feet at high water springs and 12 feet at neaps; and at Hafod works, about one mile above, there is 15½ feet and 9½ feet at the corresponding times.

LIGHTS.—From a white lighthouse with a red top, 23 feet in height, situated near the outer extreme of the west pier, is exhibited a *fixed red* light at an elevation of 35 feet above high water, and visible in clear weather from a distance of 7 miles.

A bell is sounded in foggy weather.

At the inner end of the west pier is a *fixed red* harbour light, visible from the eastward only.

Tidal light and signal.—A black ball is hoisted by day at the western pier head from 1st December to 1st April when there is a depth of 16 feet at the piers, and during the remainder of the year when there is 14 feet. An electric white light is exhibited from the east pier head at night, from the 1st December to 1st April when there is a depth of 16 feet at the piers, and during the remainder of the year when there is a depth of 14 feet.

For tidal signals at the docks, see the following description of the docks.

WET DOCKS.—The Prince of Wales dock with an area of 23 acres, is connected with a tidal basin of $6\frac{1}{4}$ acres, by a lock 500 feet in length, its gates being 60 feet wide, having a depth of 32 feet over the sill at ordinary high water spring tides, and 25 feet at neaps. The lock, dock, and approaches are illuminated by electricity.

Tidal signals.—Vessels approaching the Prince of Wales dock by day and wishing to enter, must show a flag under the foreyard, and by night a *white* light amidships between the side lights and upon the level therewith.

When the gates of the lock are open and clear for the admission of vessels, a red diamond at the masthead by day, and three *green* lights in a triangle by night, are shown from the seaward end of the lock.

When vessels are leaving the dock, or when the entrance is obstructed, a red diamond half-mast by day, and three *red* lights in a triangle by night, are shown from the seaward end of the lock; at such times no vessel is to run for the entrance. The outer lock gates will generally be open from $2\frac{1}{2}$ hours before, to half an hour after high water.

South dock is 1,500 feet in length, and covers about 13 acres; it is connected with a half-tide basin of 4 acres, by a lock 300 feet in length, having three gates 60 feet wide; the entrance gate to the basin is 70 feet wide, with a depth of 24 feet over the sill at springs and 17 feet at neaps.

Tidal signals.—All vessels intending to enter the South dock must show a flag by day, and a *white* light by night on the port side. A red flag by day, and two vertical *green* lights by night, will be shown from the flagstaff eastward of the half-tide basin, when the gates are open and clear for the admission of vessels; a red flag by day half-mast, and two vertical *red* lights at night when vessels are leaving or entrance foul, and at such times no vessel is to run for the dock entrance. The half-tide basin will generally be open from $2\frac{1}{2}$ hours before until half an hour after high water.

North dock or Float is $10\frac{1}{2}$ acres; it is connected with a half-tide basin of $2\frac{1}{2}$ acres by a lock 160 feet in length, by 56 feet in width, having at its seaward entrance gates of 60 feet width, with a depth of 23 feet over the sill at high water springs. At the northern end of the Float there is an extension of $1\frac{1}{2}$ acres communicating with the canal and the river, by a lock 95 feet in length by 35 feet in width.

There is also the Beaufort wet dock of one acre, entered from

North dock, and a patent slip capable of taking up a vessel of 1,100 tons.

Tidal signals.—From the North dock a red flag at the masthead by day, and two horizontal *green* lights by night, will be shown from the Capstan point eastward of the half-tide basin, when the entrance is open and clear; a red flag half-mast by day, and two horizontal *red* lights by night, when vessels are leaving the docks or the entrance is foul. The half-tide basin will generally be open from 2½ hours before until half an hour after high water.

New cut.—All vessels intending to proceed through the bridge in the New cut, must show a flag by day, and at night a *white* light on the starboard bow. A *green* light will be exhibited at night from the bridge when the passage is clear; when a *red* light is shown, or a red flag by day, the passage is foul, and vessels must bring up to prevent accidents.

Graving docks.—There are seven or more graving docks at Swansea; the largest is 350 feet in length, 47 feet wide in the entrance, with a depth on sill of 24 feet at high water springs. See the Dock Book for details.

Hydraulic appliances are established along all the docks for working the gates and bridges, loading and discharging vessels; and the docks are connected with the South Wales, Llanelly, Neath valley, Swansea valley, and Mumbles railways.

Time signal.—A time signal is established on the old Eastern pier. The signal is made once daily, except on Sundays and public holidays, and is a gun, which is fired at 0h. 44m. 18s., local mean time, equivalent to 1h. 0m. 0s. Greenwich mean time.

Supplies of every description can be procured, and water at the docks by hose, at the rate of 2s. for the first 100 gallons, and 1s. 6d. for every additional 100.

There are two sailors' homes within a short distance of the docks.

Trade.—The trade of Swansea is very extensive both in coal and metals, the yearly importation of ores alone exceeding in value three millions and a quarter.

The chief manufactories are in metals, such as copper, iron, steel, spelter, tin plate, ships sheathing, and patent fuel; there are also chemical works, potteries, and ship-building yards both for wood and iron.

The aggregate tonnage of vessels entering and leaving amount to about two millions.

Consuls and vice-consuls of the principal states are resident. The population of the borough in 1881 was 65,597.

NEATH RIVER rises in Brecknockshire, and after a course of more than 30 miles in a south-west direction, enters Swansea bay at Briton Ferry. It is navigable for vessels of 14 feet draught at springs and 8 feet at neaps to the town of Neath, $3\frac{1}{2}$ miles above its entrance, and is confined between slag embankments for the greater part of the distance. The river is subject to heavy freshes, which vessels must consequently be prepared for.

The wet dock at Briton Ferry has a depth of 24 feet on its sill at high water springs, and there is rather better water in the channel through the sands from sea.

From the offing, the mouth of the river is well marked on the north by Earlswood, a long low hill about half a mile within the shore, with a well defined western summit elevated 263 feet; and by the wooded hills over Briton Ferry to the south-east, backed by the bold hill Cwm Bychan, with a conspicuous smoke shaft on its summit, elevated 1,178 feet.

The estuary of the Neath lies between Crymlyn burrows and Witford point, the distance between being about half a mile; the coast between it and Swansea is low and backed by sand hills. From Swansea, eastward, the low water feature, composed of sand and mud, increases in extent, filling the whole of the entrance to Neath river to the distance of 2 miles off shore.

The channel.—Buoyage.—From the south pier head of Briton Ferry docks, an embankment or slag breakwater, 2 feet above high water ordinary spring tides, extends about half a mile in a W. $\frac{1}{4}$ S. direction. From thence a training wall extends towards the low water, gradually lowering in height and marked every 300 yards by red stake beacons with tidal lights at night, nearly to its extreme.

The navigable channel 250 feet in width, runs close north of this embankment, and is confined on its north-west side by a sprinkling of slag, along which are several black buoys. A fairway buoy in 2 fathoms, painted red and black in vertical stripes, with staff and cage, marks the entrance, with the outer light on the slag embankment bearing N.E. by E. $\frac{1}{2}$ E. distant $1\frac{9}{10}$ miles, and the Mumbles lighthouse W. $\frac{1}{2}$ S. A red can buoy, dry at low water springs, lies 7 cables within the fairway buoy in the direction of the outer light, marking eastern side of channel.

Tidal lights.—At night, from half flood to half ebb, three *fixed white* lights are exhibited on the embankment and training wall,

eastern side of channel. The inner light is situated at the outer extreme of the slag embankment; the middle light 1,077 yards seaward of it, and the outer, two lights horizontal and 5 feet apart, the same distance seaward of the middle light.

Pilots and steam-tugs.—There are several pilot boats belonging to Neath, which are schooner or cutter rig as those of Swansea, having the letter N and number on the bow and sail; they are generally to be found at the Mumbles or cruising in the bay.

Several steam-tugs are also attached to the harbour, and vessels commonly tow in and out, except under special circumstances; the signal for them is, two flags at the main mast-head.

Directions.—The fairway buoy should be passed close to on either hand, steering for the red buoy on the right or eastern side of the channel, which is straight, and marked as before-mentioned, by red beacon posts and buoy on the starboard hand on entering, and black buoys on the port. The channel lies close along the embankment, and is clear to the entrance basin at Briton Ferry wet docks.

At high water there will not be a less depth than 25 feet at ordinary springs, and 17 feet at neaps.

Briton Ferry.—Wet Dock.—Briton Ferry, situated on the east bank of the entrance to Neath river, and included in the port of Neath, is the chief place for shipment of the coals and other minerals of the district; it is the sea terminus of the Vale of Neath railway, and is further connected with Neath by a canal; there are extensive iron foundries and other works at Briton Ferry, from which quantities of bar and pig iron are exported.

In 1888 the number of vessels entering the port amounted to 989, of the aggregate tonnage of 137,927 tons; population in 1881 was 12,089.

The port accommodation consists of a wet dock, owned by the Great Western Railway Company, of 13 acres, with gates 50 feet wide, and a depth over the sill at springs of 25 feet, and at neaps 17 feet; also a tidal basin of 10 acres. Hydraulic power works the cranes and other machinery for the loading and discharge of vessels, and water is supplied by hose at the dock gates.

Lights and signals.—On the north side of the dock entrance a ball will be hoisted by day, and a *green* light by night, when the gates are open and the passage clear for entering; if not clear, there will be no ball by day, and by night a *red* light will be shown. Square-rigged sailing vessels, intending to enter Briton Ferry dock

must hoist a flag at the fore-yard arm ; and fore and aft vessels, a flag at the cross-trees. Steamers, including tugs with vessels in tow, must give one long blast of the whistle on approaching the entrance to outer basin. Sailing vessels by night to show a *white* light over the bow.

Above Briton Ferry.—Nearly three-quarters of a mile above Briton Ferry on the eastern side of the river is the Giant's Grave pill, convenient for small vessels out of the tide, and where also good water can be obtained. On the west side, a quarter of a mile above, is Red Jacket pill, in connection with the copper works, and with the Neath and Swansea canal. On the same side is the Neath Abbey coal bank, and above, the Abbey pill near to the extensive ruins, and where there is a ship-building and machinery establishment.

There are several copper and other works along the banks of the river, and wharves or stages are built out to low water mark for discharging.

Wharves.—The following are the depths alongside the several shipping places :—Vale of Neath railway wharf, $17\frac{1}{2}$ feet ; Giant's Grave quay, 18 feet ; Red Jacket pill, 11 feet ; and Neath quay, $12\frac{1}{2}$ feet at high water spring tides. There is about 7 feet less at high water neaps at these places.

Neath dock.—The wet dock, under construction by the Neath Harbour Commissioners, occupies a space of about $1\frac{1}{4}$ miles, on a bend of the river, extending from a little above Red Jacket pill to about one-quarter of a mile above Abbey pill, with a width of 350 feet, and enclosing an area of 64 acres. The lock, the entrance to which is close to Red Jacket pill, is 300 feet in length, by 150 feet in width, with gates 55 feet wide, having a depth over the sills of 25 feet at springs and 17 feet at neaps. The most recent hydraulic appliances will be provided for working the gates, and also for loading and discharging vessels.*

Neath New channel.—Eastward of the wet dock works, a temporary new channel or navigable cut has been made by which the tidal water ebbs and flows, and the following regulations are to be observed for carrying on the traffic :—

Lights.—Three *red* lights, 10 feet above high water, are exhibited on each side of the new channel ; those on the western side are only visible to vessels going up river ; those on the eastern side are only visible to vessels coming down river.

* The new works are for the present discontinued. Lieut. Gwyn Lewis, Harbour Master, 1889.

Signals.—The signal-post on Ynys Arwed corner is, during the day, worked with arms painted red and white; during the night with coloured lights; the arms and lights are about 30 feet above high water springs.

During the day.—No vessel going up river to pass the signal-post when the western arm is up. No vessel coming down river, to pass the upper red light-post on the eastern side when the eastern arm is up.

During the night.—No vessel going up river to pass the signal-post when a *red* light is visible on it.

No vessel, coming down river, to pass the upper *red* light on the eastern side of the new channel, when a *red* light is visible on the signal-post.

A *green* light on the signal-post indicates that a vessel may proceed up or down as the case may be.

Neath, a seaport and borough, is upon the east bank of the river, surrounded by hills and valleys of mineral wealth. The river, as before stated, is navigable for vessels of 14 feet draught at high water springs, and 8 feet at neaps, with a depth of $12\frac{1}{2}$ feet alongside the wharves; it is crossed above the quays by three bridges. Neath is a station of the South Wales, Neath Valley, and Neath and Brecon railways, and the canal from Briton Ferry passes on to Abernant 13 miles up the valley.

The principal exports are, coal of various kinds, iron, tin, copper, and fire-bricks, amounting to about 300,000 ton; and its imports, iron and copper ores, timber, &c.

The population of the borough of Neath in 1881 was 12,089.

PORT TALBOT.*—The coast from Briton Ferry about 3 miles to Aberavan, or port Talbot, is low and sandy, backed by the bold hill of Mynydd Dinas, elevated 832 feet, and the higher ground behind, with the conspicuous smoke shaft on Cwm Bychan 1,178 feet above the sea, already alluded to.

The port is easily identified by its breakwater, and also by the conspicuous long terrace of white cottages known as Constantinople, situated in rear of the copper works with tall chimneys at the south end of the port.

The sandy low-water shore dries out about 4 cables off the port, the soundings deepening gradually to 4 and $4\frac{1}{2}$ fathoms at the distance of one mile.

* See Admiralty plan of Swansea bay, No. 1,161.

The port, formerly a shallow inlet, one mile in length, has, by means of embankments, been converted into a spacious wet dock, of irregular breadth, connected with the outfall of the Afon Avan by a straight cut through the sand-hills.

Within the breakwater, the cutting leading to the entrance lock of the port has an average breadth of 270 feet; the channel of the overflow of the river turns northward from it.

The lock is 300 feet in length, by 45 feet in breadth, with a depth on sill of $22\frac{1}{2}$ feet at ordinary high-water springs, and 14 feet at neaps; about the same depth will be found in the entrance channel, by keeping close northward of the breakwater. The float or harbour has a bottom of mud, and there is ample wharfage with berths affording from 15 to 18 feet water, connected with the South Wales and Cwm-Avan railways, and by tramways with the various collieries in the district. The available space is about 20 acres, which is capable of considerable extension.

Directions.*—Pilots and steam-tugs.—A pilot schooner, with P.T. on her bow, is generally cruising to the westward of the entrance, and port Talbot pilots will always be found at the Mumbles, from whence it is better to procure one, and vessels must not attempt to enter the port without. A steam-tug is stationed at the harbour, and when practicable will go out to vessels off the entrance, if with their colours up.

In fine weather, vessels arriving off the entrance before the lock gates are open, should anchor in the offing abreast, in a depth of not less than 6 or 7 fathoms. In case of stress, small craft may run in if the tide admits of their doing so, stopping their way against the bank in the cut, a couple of hundred yards below the lock.

In the channel of the Afon Avan northward of the cut, the ground is hard but level, and fit for coasters to lay on for repair.

From half flood until low water the tidal stream apparently sets northward along the coast, across the head of the breakwater. A ground swell sends a very heavy sea home to the entrance.

Trade.—The chief imports are, iron and copper ores, coprolites, stock tin, palm oil and pit-props; and the exports, manufactured iron, tin, copper, superphosphates, coal and coke. Ship-building is carried on to a small extent. Good water may be obtained in the south-east part of the dock at Taibach, and general supplies at Aberavan, which is situated on the right bank of the river, at about half a mile from the port.

* Directions for Swansea bay, *see* p. 152.

In the year 1888, 759 vessels entered the port, of the aggregate tonnage of 125,348 tons.

The population of Aberavan, Cwmavan and Taibach amounts to about 13,000.

The former channel of the Afon Avan is one mile southward of the entrance to Port Talbot; the opening is a quarter of a mile wide between the sand-hills, but entirely disused by vessels.

COAST.—From Port Talbot to Sker or Scar point, a distance of 5 miles, the coast consists of sand-hills, divided into the Margam and Kenfig burrows by Kenfig river. Scar point is low, dark, and rocky; it terminates the long line of sand-hills, and is, as before mentioned, the eastern boundary of Swansea bay.*

From Scar point to Porthcawl the distance is $2\frac{1}{2}$ miles, and the high water feature is of a low rocky character, with some grassy bights. Off Scar point a ledge dries out at low water to the distance of 2 cables; and half a mile to the northward is a rock and mussel patch extending 5 cables out. Southward of the point is another patch, a similar distance from it, and one-third of a mile from the shore; one cable beyond it is a detached rock awash at low water springs. From thence the margin of the low water is sand for about one mile fronting the bay, within which is the ruins of castle Morlais, thence on to Porthcawl pier rocky ledges front the coast to the distance of one cable.

With westerly and southerly winds, there is always a heavy surf rolling along the eastern shore of Swansea bay, preventing all boat communication with the shore except in the harbours.

Aspect.—This coast is mostly flat for above a mile inland, and the chief objects useful for leading marks are as follows:—Scar house, a dark looking farm about half a mile within the point; Kenfig church, grey, with a square tower, in a clump of trees, $1\frac{1}{2}$ miles north-eastward of Scar point; Margam wood, a clump of firs on a rise, 2 miles eastward from the point, and elevated 302 feet; Newton down mill stump, elevated 307 feet, $1\frac{3}{4}$ miles north-eastward of Porthcawl lighthouse; and Rhwchiwns farm one mile north-west of the lighthouse.

Off-lying dangers.—Directions.—From Kenfig river to Porthcawl the coast is fronted by the Kenfig, Hugo and Scarweather sands, with Shord channel between, described on pages 149–151.

* See Admiralty chart, Kenfig river to Nash point, No. 1,183; scale, $m = 2.5$ inch.

At night, the white sector of Porthcawl light kept in sight leads southward of the Scarweather and the dangers in-shore of it; and the Mumbles light on a bearing of N. $\frac{1}{2}$ E. leads one mile westward.

PORTHCAWL, a tidal harbour, near the eastern extreme of Swansea bay, consists of an inner wet dock of $7\frac{1}{2}$ acres, connected by gates, 55 feet wide with a half-tide basin of $1\frac{1}{2}$ acres, having an entrance 62 feet wide and conducting piers extending south-west 250 feet in length. At high-water spring tides there is a depth of 22 feet over the sills and within the wet dock, and at neaps 15 feet, with about the same depths in the entrance channel. The harbour is protected from south-west winds by a breakwater extending S.S.E. $\frac{1}{2}$ E. for 600 feet, with a lighthouse on its extreme; in stormy weather, when the run of the sea is great, the mouth of the half-tide basin is closed by booms. At the back of the breakwater a rocky ledge dries out about one cable at low-water springs, whilst off its extreme the foreshore of sand dries out about 30 yards, thence curving towards a rocky point about a third of a mile south-eastward; within the breakwater the bottom is gravel and mud, and that of the basin is hard but smooth.

Fairy rock, awash at low-water springs, lies South $6\frac{1}{2}$ cables from Porthcawl lighthouse; at $1\frac{3}{4}$ cables N.W. by N. of the rock is a patch of $1\frac{3}{4}$ fathoms, with a black and white chequered can buoy in 4 fathoms at $1\frac{1}{2}$ cables westward of it, from which Porthcawl lighthouse bears N.N.E. $\frac{1}{4}$ E. distant $5\frac{1}{2}$ cables.

Tusker rock.—About S.S.E. $1\frac{2}{3}$ miles from Porthcawl lighthouse, and $1\frac{1}{2}$ miles W.S.W. from Ogmere river, is the centre of Tusker rock, the highest part of which dries 12 feet at low-water springs; its extent is a little over half a mile, but irregular in outline; the water is shallow within it, with rocky patches in places, but there are depths of 4 to 5 fathoms at a quarter of a mile south and south-west of it. Detached patches of $4\frac{1}{4}$ fathoms, rock, lie from 5 to 7 cables south-westward of the Tusker.

Midway between Tusker and Fairy rocky buoys is a rocky patch of 10 feet, with Porthcawl lighthouse bearing North $1\frac{1}{10}$ miles.

Buoy.—About one cable westward of the south-west point of the Tusker is a can buoy, painted in black and white vertical stripes, with staff and cage; it lies in 5 fathoms, with Clevis house at Newton Nottage in line with Newton mill stump, and Porthcawl pier lighthouse N. by W. $\frac{1}{8}$ W.

Clearing mark.—Nash high light bearing eastward of S.E. $\frac{1}{2}$ S. leads southward of the Tusker and Fairy rocks. At night, keep

southward of the *red* ray of light shown from the upper Nash lighthouse. See p. 166.

LIGHTS and tidal signals.—From Porthcawl pier head a *fixed* light is shown from the lighthouse, at an elevation of 34 feet above high water, visible about 11 miles in clear weather. It shows *red* northward of E. by S. to S.E. $\frac{1}{2}$ S.; *white* between N.E. by E., and E. by S.; and *green* from N.W. $\frac{1}{2}$ N. to N.E. by E.

From near the inner end of the breakwater a ball is hoisted by day, and two horizontal *red* lights, 15 feet apart, shown at night, when the gates are open for vessels.

Tides.—It is high water, full and change, at Porthcawl at 6h. 8m. local, or 6h. 23m. Greenwich time. Equinoctial springs rise 34 feet, ordinary springs 28 $\frac{1}{2}$ feet, and neaps 21 $\frac{1}{4}$ feet. Off the port the tides run about 3 knots, increasing towards Scarweather light-vessel.

Anchorage.—From abreast the lighthouse to half a mile eastward of it, there is anchorage northward of Fairy rock buoy in from 5 to 3 fathoms of water; here vessels in moderate weather may anchor when waiting for tide to enter the harbour; the holding ground, however, is not good.

Pilots and steam tugs.—Licensed pilots are always in readiness to attend on vessels, and will board them outside in moderate weather. A stranger should hoist the usual signal as soon as it can be distinguished.

The signal for the tug which belongs to the port is a whiffed ensign by day, and a *white* light over either of the side lights at night.

Directions.—The gates of the basin will be open when there is about 16 feet water within, and a vessel may usually make for the harbour at about 4 hours flood.

The approaches to Porthcawl are so well defined by day and night that few directions are required. Clearing marks have already been given for the Scarweather sands, p. 150. From the westward, from abreast Scarweather light-vessel, a course E. by S., can be steered for Porthcawl breakwater, observing that this bearing leads only 1 $\frac{1}{2}$ cables southward of the sand and of east Scarweather buoy; when Newton down mill stump comes on with Rhwchiwns farm, the vessel will be eastward of it.

If working up, the Scarweather and Nash sands will be cleared by keeping Porthcawl lighthouse between the bearings of E. by S. and N.E. by E.

In a sailing vessel, if the wind is from the westward, it is better to keep under way to windward and wait the tide, than anchor. If

unable to procure a pilot round the lighthouse close, and if the entrance to the half-tide basin cannot be fetched, anchor, and assistance will soon be at hand. The helm must be carefully attended, as the space is confined, and often a heavy ground swell increases the difficulty; for the latter reason, vessels should, before leaving port, have everything secured.

By night the same safety will be maintained by keeping in the *white* sector of Porthcawl light; or between the bearings of E. by S. and N.E. by E., before mentioned.

Coastguard and lifeboat.—A lifeboat is stationed a little within Porthcawl breakwater, and a life-saving apparatus is kept at the coastguard station, near to the tidal signal staff.

Supplies of ordinary description can be obtained, and water from hydrants along the west side of the wet dock.

Trade.—Large supplies of coal, iron, and coke are shipped from the mineral districts in the neighbourhood. In the year 1888, 939 vessels entered the port, of the aggregate tonnage of 105,281 tons register; the export of coal amounted to 100,000 tons.

The docks are connected by a railway with the Great Western line.

Population in 1888, including the villages of Newton and Newton Nottage, 1,602.

COAST. — From Porthcawl the coast trends south-eastward $2\frac{1}{2}$ miles to Ogmores river, with a range of sand-hills, named Newton burrows, extending in therefrom about one mile. On the inner margin of the burrows, about one mile from Porthcawl, is the village of Newton Nottage with its steeple church; it is fronted by a low point, with rocky ledges drying out at low water to about 2 cables; thence eastward is a sandy beach, increasing to half a mile in extent at the outlet of Ogmores river. Hence the coast trends southward for Nash point, with a general bold margin, the cliffs rising from 100 to 200 feet, and the connected low water of rock and sand dries out about 2 cables.

Ogmores down, elevated 321 feet, falls abruptly towards the river, and rounded hills about the same height extend onwards to Nash point. On the down, midway between Dunraven castle and Ogmores river, and half a mile back, is Groes house, which, in line with Dunraven tower, leads through Nash passage. Under Dunraven is the only good landing place on this part of the coast.

Dunraven castle.—About midway between Ogmores river and the Nash, is Dunraven castle and park, with a flagstaff elevated

232 feet, a tower a little south-east of it, and a summer-house towards the extreme point of the cliff, all of which are useful sea marks. A little southward of Dunraven castle is a ledge from a half to three-quarters of a mile in width, extending along shore for $1\frac{1}{4}$ miles, having patches of 6 to 9 feet.

NASH POINT. — LIGHTS. — Nash point is an abrupt and prominent feature of the north shore of the Bristol channel, which is there contracted to half the width it is abreast the Mumbles.

Two lighthouses stand upon a table-land 77 feet above high water, close to the edge of the cliff; the western or lower lighthouse is 600 feet from the point, and from it the eastern and higher one bears S.E. by S. $\frac{3}{4}$ E. distant 333 yards; they are elevated respectively 136 and 182 feet above high water. The eastern light-tower is painted in black and white horizontal bands; the western one, and the keepers' dwellings, are painted white.

Nash point high light is *fixed white* between the bearings of about S.E. by S., and N.W. $\frac{1}{2}$ W., and is visible in clear weather from a distance of 19 miles. Between the bearing N.W. $\frac{1}{2}$ W. and the shore, over Breaksea ledge, the light is *red*. A ray of *red* light is also shown from a window below the lantern of the high lighthouse, in the direction of Tusker and Fairy rocks, between the bearings of S.E. by S. and S.E. $\frac{1}{2}$ S. (Both the high and low lights are seen over this sector.)

Nash point low light is *fixed white* westward of the line of bearing N.N.W. $\frac{1}{4}$ W., and is visible in clear weather from the distance of 17 miles; eastward of that bearing the light is obscured.

A faint light is seen beyond the bearings given, especially when within about 6 miles of the lights.

Clearing marks. — The Nash lights in line bearing S.E. by E. $\frac{3}{4}$ E. lead southward of Nash and Scarweather sands; the eastern limit of the low light, N.N.W. $\frac{1}{4}$ W. leads $1\frac{1}{2}$ miles westward of Culver sand, page 81. The high light, showing *white*, or by day the high lighthouse on with a white Trinity mark on the cliff, half a mile to the eastward of it, bearing N.W. $\frac{1}{2}$ W., leads southward of Breaksea point ledge buoy. The south limit of the *red* light shown over the Tusker, leads 2 cables southward of Tusker buoy; but vessels should keep southward of this sector.

NASH SANDS extend in a north-westerly direction for about 7 miles from Nash point, with a breadth of one to 6 cables, shelving down abruptly on both sides into 6 to 8 fathoms water, over sand or stones or coarse gravel; they are divided into three portions, namely, the Nash, the Middle, and West Nash.

The Nash dries 6 feet at its eastern end, and is about one mile in length by $1\frac{1}{2}$ cables in breadth ; a tongue, with less than 6 feet water, extends $1\frac{1}{2}$ miles westward of the Nash ; here the sands are at their maximum breadth, namely, 6 cables.

Nash Middle, about a quarter of a mile in length, with depths of 3 to 6 feet over it, lies $1\frac{3}{4}$ miles westward of the Nash tongue, with depths over the connecting ridge of $1\frac{1}{4}$ to $2\frac{1}{4}$ fathoms.

West Nash extends $2\frac{1}{2}$ miles westward from the Middle, with depths of from $1\frac{1}{4}$ to 3 fathoms over a bottom of fine brown sand. About three-quarters of a mile westward of the West Nash, and outside the buoy, are rocky patches, having from $4\frac{1}{2}$ to 5 fathoms over them ; and about one mile southward of the West Nash are several rocky heads, having $5\frac{1}{2}$ fathoms water over them.

Buoys.—Four buoys mark the southern side of Nash sands.

West Nash, at the west extreme of the 5 fathoms limit, placed in $5\frac{1}{2}$ fathoms, is a spherical buoy painted in black and white rings, and surmounted by a staff and diamond, from which Newton down mill stump is in line with the coast-guard flagstaff at Porthcawl ; Nash high lighthouse, its height open northward of the low lighthouse ; and the Middle Nash buoy, S.E. $\frac{3}{4}$ E. distant $2\frac{4}{10}$ miles.

Middle Nash, in $5\frac{1}{2}$ fathoms, situated 2 cables westward of Middle Nash sand, is a can buoy painted in black and white vertical stripes, and lies, with Nash high light-tower, its height open north of the low lighthouse ; Scar house in line with Rhwchiwns point, North ; and east Middle Nash buoy S.E. by E. distant $1\frac{9}{10}$ miles.

East Middle Nash is a black and white chequered can buoy in 5 fathoms, with Nash high lighthouse, its height open northward of the low lighthouse ; Dunraven summer-house, its width open eastward of a round tree, the westernmost on the high land ; and East Nash buoy S.E. by E., distant $2\frac{6}{10}$ miles.

East Nash is a spherical buoy painted in black and white horizontal rings, in 5 fathoms, $2\frac{1}{2}$ cables S.S.E. of the east extreme of Nash sands, and 4 cables from Nash point, with the low lighthouse bearing E.S.E.

Tides.—It should be borne in mind, when closing Nash sands, that the ebb and flood streams set obliquely across them, or N.N.W. and S.S.E. Outside them, however, or when the high lighthouse is open southward of the low one, the flood and ebb streams set fairly along the sands S.E. by E. and N.W. by W., both turning at the times of low and high water by the shore, with about half-an-hour slack ; their velocity amounts to from 4 to 5 knots at springs, and 3 knots at neaps.

Directions.—Clearing marks.—Nash lights in line bearing S.E. by E. $\frac{3}{4}$ E. leads southward of Nash sands, excepting at its south-east extreme; Newton down mill stump on with Seabank house N.E. by E. $\frac{3}{4}$ E., leads westward of the sands, and to Porthcawl; and Groes house on with Dunraven tower leads eastward of Nash sands, and through the entrance to Nash passage.

If at night, and from the eastward bound to Porthcawl, do not haul northward of Nash lights in line until Porthcawl light shows *white*, when it may be steered for, westward of the Nash sands and of Fairy rock.

When working in thick weather, outside the Nash sands, it is advisable not to approach them nearer than a depth of 10 fathoms.

Nash passage.—Between the east end of Nash sand and Nash point lies Nash passage, $1\frac{1}{2}$ cables in width, with depths of about 5 fathoms; it increases in breadth to about $1\frac{1}{2}$ miles abreast Tusker rock, where in nearly mid-channel are patches of rock, having $4\frac{1}{2}$ fathoms water; also at about three-quarters of a mile within east Nash buoy are patches of $3\frac{1}{2}$ to 4 fathoms, near the fairway; with these exceptions the ground is even, with depths of 6 to 8 fathoms, over sand, broken shells, and stones.

Directions.—Groes house in line with Dunraven tower bearing N. $\frac{1}{2}$ W., leads between Nash point and Nash sand; when the high lighthouse bears S.E. $\frac{1}{4}$ S., it should be brought astern, which bearing leads southward of Tusker rock and buoy; thence to Porthcawl, Scar point, open of Rhwchiwns point leads westward of Fairy rock.

Anchorage.—In moderate weather temporary anchorage, in about 5 fathoms, may be taken up within the eastern end of the Nash sands.

COAST.—St. Donat's bluff.*—At three-quarters of a mile south-east of Nash point is St. Donat's bluff, a little within which are the ruins of St. Donat's castle and watch-tower; thence the coast is nearly straight for Breaksea point, a distance of about 5 miles. The cliffs are about 100 feet high as far as Summer-house point, but from it to Breaksea point the coast is low, with shelving low water ledges extending out about $1\frac{1}{2}$ cables, except off Colhugh point, hereafter mentioned. The town of Llantwit Major, with its square tower church and white windmill, lies about one mile back from the coast, at about $1\frac{1}{2}$ miles eastward of St. Donat's. Four miles eastward of Nash point, on the cliff, is a peaked roofed cottage,

* See Admiralty chart, Nash point to New passage, No. 2,682; scale, *m* = one inch.

named the Summer-house, and half a mile northward of it is the conspicuous mill of Boverton.

Coastguard.—There is a detachment of coastguard at Llantwitt.

Colhugh reef dries out one-third of a mile from Colhugh point, situated $1\frac{1}{2}$ miles eastward of St. Donat's bluff; the reef suddenly shelves up from 6 fathoms, foul ground, at one cable beyond it; the bight between this reef and St. Donat's bluff is shallow to the distance of 4 cables off shore.

Breaksea point and ledge.—Breaksea point, composed of low sand hills, and situated 6 miles eastward of the Nash lighthouses, forms the western side of the river Aberthaw. Close within the point the sloping banks rise to 150 feet, which under certain aspects, have by their shade, proved dangerously deceptive to vessels in judging their distance off shore. Three-quarters of a mile within the point is a cluster of houses named West Aberthaw, north-west of which is Gileston rectory, a large house surrounded by trees.

The low water shore, of limestone boulders and rock, dries out a quarter of a mile from the point, filling up the bights on either side, the water deepening gradually to 4 or 5 fathoms over foul ground half a mile beyond the ledge.

Buoy.—A black and white chequered can buoy in 4 fathoms, and $4\frac{1}{2}$ cables S.W. by W. $\frac{3}{4}$ W. from the point, marks the extreme of Breaksea point ledge.

Clearing marks.—By day, Nash high lighthouse in line with, or open seaward of the Trinity white mark on St. Donat's cliff, N. W. $\frac{1}{2}$ W., leads southward of Breaksea ledge; at night, Nash high light showing *white* leads southward of the ledge. (The light shows *red* over the ledge.)

Anchorage.—**Tidal streams.**—The flood and ebb streams run about 3 knots at springs, and during the strength of the tide there is a considerable overfall off Breaksea point. On the ebb, anchorage may be taken by small craft in 3 fathoms west of Breaksea point; and vessels procuring limestone, which is here noted for its good qualities, find a convenient layerage in the entrance to Aberthaw river.

Roos point and Porthkerry.—Roos point, a limestone cliff 32 feet high, $2\frac{1}{2}$ miles eastward of Breaksea point, is the most southern point of the Welsh coast; from it the coast trends in for $1\frac{1}{2}$ miles, forming with Coldknap point, the shallow bight of Porthkerry, on the west side of which is the square-tower church of the village, and a conspicuous house, both surrounded by trees.

On the west side of Porthkerry bight, three-quarters of a mile eastward of Roos point, is Chapel rock, which dries at low water equinoctial springs only—with shallow water extending nearly 2 cables southward of it. A spit, partly dry at low water, extends three-quarters of a mile westward of Coldknap point, the east extreme of the bight, with a depth of 9 feet only between it and Chapel rock.

Clearing mark.—The summit of Sully island open of Treharnes point, the south-west extreme of Barry island, leads southward of Chapel rock in $3\frac{1}{2}$ fathoms.

BARRY ISLAND AND DOCK.*—The Barry wet dock has a depth of $40\frac{3}{4}$ feet on its sill at high water springs, and $32\frac{1}{4}$ feet at high water neaps, with the same depth in the approach, and, being 80 feet wide in the entrance, is capable of taking all classes of vessels.

Barry island, about three-quarters of a mile in length, east and west, by half a mile in breadth, and 104 feet in height near its south-east extreme, occupies a large portion of the bight eastward of Coldknap point; it was formerly separated from the main by a channel 2 cables in width, but for the purpose of constructing the Barry dock the island has been connected to it by an embankment about 200 yards in width; the dock and its approaches occupy the whole of the waterway northward and eastward of Barry island.

There is an hotel on the west side of Barry island, and a small landing-pier, with flagstaff, on the east side of Treharne point, south-west extreme of the island.

The inlet westward of Barry island, leading to Barry village, is still available for coasting craft, there being a depth of about 14 feet at half-tide, with a good bottom of mud for lying aground on. Within Coldknap point is the square tower of the coastguard (detachment) station, and the belfry of Barry church half a mile beyond.

Wet dock.—The Barry dock is 3,400 feet in length by 1,100 feet in width, with a central pier, having an area of 73 acres and quayage of 10,500 feet. It has an average depth of $35\frac{1}{2}$ feet, a depth on sill at high water springs of $40\frac{3}{4}$ feet, and at neaps $32\frac{1}{4}$ feet, as above stated. The basin seaward of it is 7 acres in extent.

The dock has two entrances; the eastern is through the basin, the gates being 80 feet wide, with the same depth as on the

* See Admiralty chart, Cardiff and Barry roads, with approaches, No. 1,182; scale, $m = 4$ inches; also No. 2682.

dock sill. The western entrance is through a lock 600 feet in length by 75 feet width in the entrance. These entrances are protected by two breakwaters, one extending from the island shore, and the other from the main, their extremes being about 150 yards apart; the channel is dredged to 4 feet at low water springs, or the same depth as on the dock and basin sills.

The dock is fitted with every appliance for rapid coaling, and its quays are connected by railway with the Welsh coalfields and the Great Western and North-Western railways. The shipment of coal is proceeding at the rate of three million tons per annum.

Graving dock.—At the north-east corner of the wet dock is a graving-dock 727 feet in length by 60 feet in width, and a depth on sill of 24 feet; the timber pond eastward of it covers an area of about 20 acres.

LIGHTS.—On the end of the west breakwater in the approach to Barry dock is exhibited, at a height of 40 feet, an *occulting white light once every five seconds*.

On the end of the east breakwater a *fixed white light* is exhibited at a height of 20 feet above high water.

For Breaksea light-vessel, about 3 miles south-westward of Barry dock, see p. 173.

Fog signal.—The foghorn on the west breakwater, during thick or foggy weather, will give one short and one long blast in quick succession *every two minutes*.

Night signals.—When there is a “free stem,” and vessels are allowed to enter the dock, a *green light* will be exhibited on the end of the eastern jetty, and a *red light* on the end of the western jetty.

When there is a “stemming list,” and vessels on that list only are allowed to enter, a *green light* will be exhibited on the end of both jetties.

Barry road affords good anchorage in moderate weather, in from 5 to 6 fathoms clay, about half a mile off the entrance to the dock. There are no dangers off Barry island and the breakwaters beyond the distance of $1\frac{1}{2}$ cables. Bendrick rock, on the outer extreme of the ledge stretching $1\frac{1}{2}$ cables off the east breakwater, is always above water. The tide at springs runs about 3 knots.

Directions.—Approaching Barry dock from the westward, the Scarweather and Nash sands will be avoided by keeping southward of the line of the Nash lights. Eastward of the Nash there are no dangers beyond half a mile off shore. Vessels entering the dock will be in charge of a pilot for the docks.

COAST.—**Sully island and Lavernock point.**—Sully island, situated about 3 miles eastward of Barry, and 2 cables off the low cliffy coast, to which it is connected by a half-tide ledge, is a narrow island about a quarter of a mile in length, and although elevated only 53 feet, stands out conspicuously.

Lavernock point is $1\frac{1}{4}$ miles eastward of Sully, whence the land turns abruptly northward to Penarth and Cardiff.

The cliff at Lavernock point is about 50 feet high, rising to 105 feet to the westward; close within the point is a small church with a belfry, and a farmhouse. Between Barry and Sully islands rocky ledges dry off at low water about $1\frac{1}{2}$ cables, fronted by mud in the bight. From Sully island eastward the rocky ledges continue, fronted by sand, to one-third of a mile off shore, to Lavernock point, off which blocks of limestone and some shingle dry out to that distance, with Ranie spit beyond it. Close eastward of Sully island, within the dry line, is a small pool, useful as a resort for Hobblers' boats on the look-out for vessels coming up channel.

Anchorage.—Half a mile westward of Sully island there is anchorage out of the strength of the tide, in $3\frac{1}{2}$ fathoms, with the south points of the island in line.

Penarth head.—From Lavernock point to Penarth head, a distance of $2\frac{1}{4}$ miles, the shore is cliffy. Penarth head is the highest headland on the north shore of the Bristol channel; its nearly perpendicular cliff is curiously veined by gypsum, and upon the summit, a little within the head, is the conspicuous tower of Penarth, with a church, its base being 216 feet above high water. In the bay northward of the head are the extensive docks of Cardiff and Penarth, and at half a mile to the southward there is the coast-guard station and lifeboat house. *See also p. 182.*

CARDIFF AND PENARTH ROADS.*—**Dangers in the western approach.**—**North side of Fairway.**—Sully ledge, situated S.W. by W. about 9 cables from the centre of Sully island, is within a depth of 3 fathoms about $3\frac{1}{2}$ cables in extent; its least water is $2\frac{1}{4}$ fathoms near its eastern extreme: the ledge lies within the 5-fathom line fronting the coast, but there is a 4-fathom channel northward of it.

Alltridge shoal, a small sand patch with a depth of $3\frac{1}{8}$ fathoms, lies nearly midway between Sully ridge and the spit extending south-westward from Lavernock point, and on the connecting ridge with about 4 fathoms water joining them; it lies with the east extreme of Sully island bearing N. $\frac{1}{2}$ E., distant half a mile.

* *See Admiralty chart, Cardiff and Barry roads, with approaches, No. 1,182; scale, m = 4 inches; also No. 2682.*

Clearing mark.—Breaksea point in line with Roos point, bearing W. by N. $\frac{3}{4}$ N., leads southward of Sully ledge and Alldridge shoal. When Sully villa is open of Sully island, a vessel will be eastward of these low-water dangers, and may haul up for West Cardiff buoy.

Lavernock and Ranie spits.—From the coast at half a mile northward of Lavernock point, Lavernock ridge, of shingle, dries out a third of a mile in a S.S.E. direction, leaving a bight with from one to 2 fathoms between it and the low line off the point.

Ranie spit is the eastern extreme of the shallow water off Lavernock point; the spit, composed of stones, is about 3 cables in extent in a north and south direction within a depth of 6 feet, with one spot dry $1\frac{1}{2}$ feet at low-water springs, from which the church within Lavernock point bears W. by N. $\frac{1}{2}$ N., distant half a mile; it is steep-to on its seaward side.

A sandy spit, with from $2\frac{1}{4}$ to 3 fathoms, extends one mile south-westward of Lavernock point. The tide sets over these banks with great strength, causing overfalls and tide rips, dangerous to boats. The south-east point of Barry island on with the south end of Sully, bearing W. $\frac{3}{4}$ N., leads southward of Ranie spit.

Buoy.—A black and white vertically-striped can buoy, surmounted by a staff and cage, lies $1\frac{1}{2}$ cables S.S.W. of the dry spot of Ranie spit, with Lavernock church bearing N.W. by W., distant 5 cables, and West Cardiff ground buoy E. $\frac{3}{4}$ N.

See p. 177 for Cardiff grounds.

BREAKSEA LIGHT-VESSEL is moored in 18 fathoms in the fairway of the Bristol channel, about 11 miles above the Nash lighthouses, and $1\frac{3}{4}$ miles W.N.W. from One-fathom bank buoy, with Flatholm light bearing East $6\frac{8}{10}$ miles, and West Culver buoy S.S.W. $\frac{1}{2}$ W., $3\frac{8}{10}$ miles.

The vessel is painted red, with a ball at the mast-head, the word *Breaksea* on her sides, and exhibits, at an elevation of 35 feet above the sea, a *revolving white* light, which attains its greatest brilliancy *every fifteen seconds*, and is visible in clear weather from a distance of 11 miles.

Fog signal.—During thick or foggy weather, the signal is *two* explosive reports (each sounding like the discharge of a gun) *every ten minutes*; the interval between the two reports will be *five seconds*.

ONE-FATHOM BANK* is the westernmost danger in the fairway of the approach to Cardiff from the westward. It is

* This name has been retained, although there is not less water, by the survey of 1885, than $2\frac{1}{2}$ fathoms.

about $1\frac{1}{2}$ miles in length in an east and west direction, by a quarter of a mile in breadth, with depths varying from $2\frac{1}{8}$ to 5 fathoms, over sand, gravel, or stones, and 6 to 8 fathoms at a short distance beyond it. The shallowest portion, $2\frac{1}{8}$ fathoms near its centre, lies with Flatholm lighthouse bearing E. $\frac{1}{2}$ N., distant $4\frac{1}{10}$ miles.

Buoy.—The west end of the bank is marked by a spherical buoy painted in black and white horizontal stripes, in 6 fathoms, 3 cables westward of the depth of $2\frac{5}{8}$ fathoms, with Flatholm lighthouse bearing E. $\frac{1}{2}$ N., distant $5\frac{2}{10}$ miles, and Breaksea light-vessel W.N.W.

Clearing marks.—Brean down in line with the south side of Steephholm, bearing S.E. by E. $\frac{1}{4}$ E., leads north-eastward of One-fathom bank. Anchor head only just open northward of Steephholm E. $\frac{3}{4}$ S. leads southward of it; and Anchor head open southward of Steephholm leads in the fairway between One-fathom bank and Culver sand.

Fairway shoals are several isolated patches of less than 5 fathoms, over sand and rock, extending in the direction of the channel for a distance of about 7 cables, at about 2 miles north-eastward of One-fathom bank; the shoalest spot, 3 fathoms, lies with Flatholm lighthouse bearing E. by S. $\frac{3}{4}$ S., distant 2 miles.

Penarth head open of Lavernock point, bearing N. by E. $\frac{1}{2}$ E., leads between the Fairway shoals and the Wolves, in not less than 6 fathoms.

FLATHOLM ISLAND* lies $2\frac{1}{3}$ miles south-eastward of Lavernock point, 4 miles from Brean down on the opposite coast, and about 2 miles northward of Steephholm, which is described on page 81; the island is low and nearly circular, with a diameter of one-third of a mile, and has a cliffy outline, elevated about 65 feet at the southern end, sloping gently towards the north end.

Rocky ledges, with shallow water a little beyond them, dry off to the distance of one cable at low water.

On the south and highest part of the island is a lighthouse with keepers' dwellings attached, and on the north side a farmhouse, and other buildings in connection with the fortifications.

Tugs.—Landing.—The best landing place is on a shingle beach at the north-east side of the island, off which is also a tolerable anchorage in 3 fathoms, sand bottom, useful for coasters, and where steam-tugs will generally be found.

* See sketch on chart No. 1182.

LIGHT.—The lighthouse on Flatholm island is a white tower 99 feet high, and from an elevation of 164 feet above high water, is exhibited a *white* light under *occultation twice* in quick succession *every half-minute*:—that is to say, it suddenly disappears for *three seconds*, and then as suddenly re-appears at full power for *three seconds*; and again suddenly disappearing for *three seconds*, re-appears at full power for the remainder of the *half-minute*; in clear weather it should be visible from a distance of 18 miles.

Red sectors are shown between the bearings S.E. $\frac{3}{4}$ E. and S. by E. $\frac{3}{4}$ E., over the Wolves; and S. $\frac{1}{2}$ E. and S.W. $\frac{1}{4}$ S., over Centre ledge; the *white* sector between these, or from S. by E. $\frac{3}{4}$ E. to S. $\frac{1}{2}$ E., covers the approach to Cardiff road between Ranie spit and West Cardiff buoys.

Surrounding Dangers and Buoys.—The main channel between the Holms, with depths of 11 fathoms and upwards, approaches within a quarter of a mile of Flatholm lighthouse, but rocks and shoals, trending in the direction of the channel, extend one mile off the other three sides of Flatholm.

New patch, of 7 feet least water, lies half a mile eastward of the lighthouse; this rocky ground, within a depth of 3 fathoms, is about half a mile in length by $1\frac{1}{2}$ cables in breadth.

Buoy.—At the north-east end of New patch, in 4 fathoms, just eastward of a 10 feet patch, there is a chequered black and white can buoy, with the lighthouse bearing W.S.W., distant 7 cables. For $1\frac{1}{2}$ miles north-eastward of this buoy, and uniting nearly with Monkstone flats, the ground is uneven, with depths of $3\frac{1}{4}$ to 5 fathoms over sand and stones; between New patch and Flatholm island, there is a passage one cable wide, with depths of 8 to 11 fathoms.

Mackenzie shoal.—The west end of this shoal is one mile S.W. by W. $\frac{1}{4}$ W. from the south point of Flatholm, towards which it extends for about 7 cables; the least water is $1\frac{1}{2}$ fathoms, sand, near its centre, but the sand probably only covers a rocky base.

Buoy.—A spherical buoy, painted in black and white horizontal stripes, with staff and diamond, lies in 3 fathoms near the west extreme of Mackenzie shoal, with Flatholm lighthouse N.E. by E. $\frac{1}{4}$ E., one mile. A patch of 3 fathoms lies half a cable outside the buoy.

There is a depth of 12 fathoms within 2 cables of the south edge of the shoal, and to the westward it slopes gradually into 9 fathoms, but northward towards the Wolves, a spit with from $2\frac{1}{2}$ to 3 fathoms extends 7 cables westward from Flatholm

Clearing marks.—Brent knoll in line with the east side of Steepholm bearing S.S.E. $\frac{1}{2}$ E. leads westward of Mackenzie shoal ; Monkstone beacon, well open of the west end of Flatholm, bearing N.E. $\frac{1}{4}$ N. leads north-west of it ; and the same beacon in line with the east side of Flatholm N.E. by N. leads south-eastward of it.

Flatholm shelf comprises three rocky patches about half a mile in extent, with depths of $2\frac{1}{2}$ to 3 fathoms, lying within one third of a mile of the north side of Flatholm ; between them and the Wolves there is a channel of 6 fathoms water.

The Wolves lie N.W. $\frac{1}{4}$ W. distant 8 cables from the nearest point of Flatholm ; they consist of three small rocky heads about half a cable in extent which dry $5\frac{1}{2}$ feet at low-water ; their south side is bold-to, but a patch of 16 feet lies nearly one cable to the westward ; over these rocks the tides run with great strength during springs.

Buoys.—Two buoys mark the Wolves ; the western buoy is spherical, painted in black and white horizontal stripes, and lies in 4 fathoms, W. by S. $\frac{1}{2}$ S. distant $1\frac{1}{2}$ cables from the rocks, with Flatholm lighthouse bearing S.E. $\frac{1}{3}$ E. $1\frac{1}{8}$ miles.

The east buoy is spherical, painted in red and white horizontal stripes, and lies in 5 fathoms, E. by N. $\frac{1}{4}$ N. $1\frac{1}{2}$ cables from the rocks, with Flatholm lighthouse S.E. $\frac{3}{4}$ S. one mile.

Monkstone, situated N.E. $\frac{3}{4}$ N. $2\frac{1}{2}$ miles from Flatholm lighthouse, and south-eastward of Cardiff road, is a rock one cable in extent, which uncovers $10\frac{1}{2}$ feet at low water ; it lies near the middle of a 3-fathom shelf which extends north-east and south-west from the rock for a distance of 4 cables.

A stone beacon, surmounted by a safety cage 40 feet above high water, is erected on the Monkstone. See sketch on chart No. 1182.

Centre ledge lies near the north-east extreme of the bank with less than 5 fathoms, which extends from the Wolves in the direction of the Monkstone ; the least depth over the ledge is $2\frac{3}{4}$ fathoms, rocky bottom, but this is but little less than the surrounding depths, which are from 3 to 4 fathoms. The channel between Central ledge and the Monkstone is half a mile wide, with depths of 7 to 8 fathoms.

Fairway.—**Depths.**—From abreast the Nash sands a depth of 10 fathoms and upwards, with a bottom of sand, or sand and stones, will be found at from 2 to $2\frac{1}{2}$ miles from the shore, running up in a gut past Breaksea light-vessel ; eastward of the One-fathom bank this gut unites with the channel of the same depth between the Holms.

The depths in the passage south of Breaksea light-vessel have been described on page 81; and between the above mentioned shoals there will be found varying depths of in from $5\frac{1}{2}$ to 9 fathoms.

Tides.—It is high water, full and change, at Flatholm and at Cardiff at 6h. 56m. local, or 7h. 8m. Greenwich time; equinoctial; springs rise $39\frac{3}{4}$ feet, ordinary springs $37\frac{3}{4}$ feet, and neaps 29 feet; neaps range $20\frac{1}{2}$ feet. The general direction of the tidal stream runs fair in the channel between the Holms, the flood at the rate of 3 knots at springs and $1\frac{1}{2}$ knots at neaps; the ebb 4 and 2 knots respectively, turning at the time of high and low water by the shore. Nearer the north side of the channel the rate is less, until off Lavernock point, where the flood runs $4\frac{1}{2}$ and the ebb 5 knots, causing a considerable overfall abreast the point.

In Cardiff road, the flood runs $1\frac{3}{4}$ knots at springs and one knot at neaps, and the ebb $2\frac{1}{2}$ knots at springs and $1\frac{1}{2}$ knots at neaps.

CARDIFF and PENARTH ROAD, situated about $1\frac{1}{2}$ miles seaward of the entrance to Cardiff docks, is about $1\frac{1}{2}$ miles in length by 3 cables in width, with depths of 4 to 6 fathoms, sand, at low water; the road is entered over a sand bar which has a depth of 14 feet at low water. The road, also the Cardiff and Penarth flats, on which vessels may lie aground, are well sheltered by the sands, nearly 5 miles in length, known as the Cardiff grounds.

There are depths of 35 to 36 feet at high water springs over the Roath and Penarth dock sills, and 26 to 27 feet at high water neaps; with the same depths in the channel from sea to Penarth dock, and 4 feet more water to the Cardiff docks.

The **Cardiff grounds** front the bight in which Cardiff is situated at the distance of one to 2 miles off shore; its shape is subject to change, and it has extended considerably to the southward in late years.* Its dry south-west extreme bears from Lavernock point about East $1\frac{1}{10}$ miles, and from thence the sands trend north-east, for $1\frac{3}{4}$ miles, with a swashway, with 4 feet at low water and about 2 cables wide, half a mile from the southern end. At 3 cables south-east of the northern end of the grounds is a narrow ridge which dries one foot, from whence a spit extends southward nearly half a mile, leaving a bight with from 2 to 4 fathoms between it and the main portion of the sands.

The average breadth of the sands is about 2 cables, and the highest part, situated 2 cables northward of the swashway, dries 13 feet.

* See Admiralty chart of Cardiff and Barry roads, with approaches, No. 1182, from a survey by Staff-Commander W. E. Archdeacon, 1885.

From the north-east extreme of the grounds a narrow ridge of sand with from 3 to 6 feet water extends $1\frac{1}{4}$ miles north-eastward, connected by two bars of sand with the shallow water extending eastward of Cardiff flats; these ridges have about 10 feet water over them, and the pool between has depths of $2\frac{1}{2}$ to 3 fathoms at low water springs.

Buoys.—Four buoys mark the Cardiff grounds on the inner or north-west side, and one the spit to the eastward.

The West Cardiff is a spherical buoy, painted in black and white horizontal stripes, with staff and globe; it lies in four fathoms, off the south-west extreme of the grounds, with Lavernock point bearing W. $\frac{3}{4}$ N., distant $9\frac{1}{4}$ cables; and the Middle Cardiff buoy N.E. by N. a little over a mile.

Middle Cardiff, a black conical buoy in 4 fathoms, lies at the north-east end of the swatchway, with Penarth church N.N.W. $\frac{3}{4}$ W. $1\frac{1}{2}$ miles; and the Hook buoy N.E. $\frac{3}{4}$ E. $1\frac{3}{10}$ miles.

The Hook, also a black conical buoy, lies in 2 fathoms, and from it the extreme of Ely river coal tips on with Penarth flagstaff point, bears N. W. by W $\frac{2}{3}$ W. $1\frac{8}{10}$ miles; and East Cardiff buoy N.E. by E. $\frac{1}{4}$ E. $1\frac{2}{10}$ miles.

East Cardiff, a black conical buoy, with staff and globe, lies in $2\frac{1}{4}$ fathoms, with the south extreme of Cardiff pier bearing W. by N. $\frac{1}{4}$ N. $2\frac{4}{10}$ miles; and the S.W. spit buoy of the Welsh grounds, E. by S. $\frac{3}{4}$ S. $3\frac{8}{10}$ miles.

Cardiff spit, on the east side of the Cardiff grounds, is a red and white chequered can buoy, in $2\frac{1}{2}$ fathoms, with Monkstone beacon bearing S. $\frac{1}{2}$ E. distant 9 cables, and Hook buoy North one mile.

ANCHORAGES.—Cardiff and Penarth road is the safest refuge on the north side of the Bristol channel; for large vessels the space for anchorage is limited, and consequently at times much crowded, and in bad weather, when the banks are covered, it is exposed to a tumbling sea from the southward. Perfect security will, however, be found for a large fleet of coasters on the extensive mud-flats above Penarth, where they can lie aground.

The deepest portion of the road lies just within the Cardiff grounds; it has depths of 4 to 6 fathoms, clay, over a space about one mile in length, from Middle buoy north-eastward nearly to the Hook buoy, by a quarter of a mile in breadth. A good position, in about $5\frac{1}{4}$ fathoms, may be taken up with the west ends of the two Holms in line, bearing S. by W., and Penarth coastguard flagstaff open a little southward of the life-boat house W.N.W. Caution is

necessary here, and in all cases where the water is shallow and the range of tide so great and rapid, to prevent the vessel grounding on her anchors.

An outer anchorage, in 6 fathoms water, is included in the space between the Centre ledge, Cardiff grounds, and the Monkstone; but the bottom is rocky in places. Also, when Cardiff road is crowded, large vessels find good anchorage eastward of Flatholm between Centre ledge and New patch, where there are depths of 5 to 10 fathoms, with good holding ground.

Tides.—See page 177.

Pilots and steam-tugs.—There is a large fleet of both pilot vessels and steam-tugs, the former being mostly cutter-rigged, with the letters C^F in their mainsails; they will chiefly be found cruising, or at anchor at Lundy, Ilfracombe, the Foreland, the Nash, and Breaksea points. The signal for a steam-tug is the ensign whiffed at the peak.

DIRECTIONS.—The approaches to Cardiff are so well marked by lights and buoys, and pilot and other assistance so numerous and ready, that beyond the foregoing description, and the caution always to be prepared with the lead, few, if any, directions are necessary. The principal channel up is northward of One-fathom bank, with Breaksea light-vessel bearing W. by S. $\frac{1}{4}$ S. astern, leaving the Wolves buoys on the starboard hand, and when Steepholm is one-third of its apparent length only open westward of Flatholm, bearing S. $\frac{1}{2}$ E., bring it astern, passing in between Ranie spit and the West Cardiff buoys; and when Sully island touches Lavernock point, steer N.E., passing westward of Middle buoy, beyond which anchorage may be taken up. If seeking shelter only, anchor near the position before mentioned, page 178, or otherwise most advantageous for the docks, to which vessels proceed with the assistance of steam.

At night, Breaksea light-vessel bearing W. by S. $\frac{1}{4}$ S. astern, leads in the fairway; when the two *red* lights on the west side of Bute docks come in line with Cardiff pier light, steer N.E. until Flatholm light shows *white*; then bring it astern, keeping in the white sector, or between the bearings of S. by E. $\frac{3}{4}$ E. and S. $\frac{1}{2}$ E., which leads between Ranie spit and West Cardiff buoys; thence steer N.E., and anchor northward of the Middle buoy.*

Bute docks (red) lights open eastward of Cardiff pier light bearing from N. $\frac{3}{4}$ E. to N. by E. $\frac{1}{4}$ E. also leads between Ranie spit and West Cardiff buoys.

* The Cardiff lights are extremely difficult to recognise owing to the numerous town lights, and in hazy weather are practically useless at this distance.

From the eastward, having passed the Monkstone ; by keeping the south point of Barry island about midway between Sully island and the main, will lead southward of Cardiff grounds ; thence pass southward and westward of West Cardiff buoy to the anchorage, as before.

The swashway through Cardiff grounds has 22 feet at half-tide, and the latest mark is Cardiff pier light N. $\frac{3}{4}$ W., or Middle buoy bearing North ; strangers should not attempt it.

RIVERS ELY AND TAFF.—The **Ely** rises in the hilly district of Glamorganshire to the westward of the confluence of the two Rhonddas ; it passes westward of Llantrissant, and close south of Peterston, St. Bride's, and St. Fagan's, and north of the villages of St. George's and Michaelston ; under Ely bridge near Llandaff, and thence, with numerous winds, through the marshy lands at the foot of Leckwith and Llandough hills, where it is crossed by railway and road bridges. After a course of 20 miles it unites with the sea, over a low-water flat of mud and stones, close under Penarth head.

The **Taff** rises on the west side of Pen-y-van, Brecknockshire, in two streams, which unite on their entrance into Glamorganshire a little north of Merthyr Tydvil ; the river passes westward of this town, so noted for its ironworks ; 12 miles southward, near Quakers yard, it receives from the eastward the Bargawd Taff, and 2 miles beyond, the Cynon from the west by Aberdare. Thus augmented the river flows on to Newbridge, and is there joined by the Rhondda, also from the westward ; its course is now south-easterly ; emerging from the hilly country at the foot of the steep falls of the Garth, it passes on to Cardiff along the west side of the town, where it is crossed by railway and other bridges. From this it winds through muddy flats for 2 miles, and enters the bay a little northward of the Ely, the length of the river from its source to Cardiff being about 36 miles. About one mile above Cardiff bridge there is a weir across the river, from whence the water is conducted by a feeder for the supply of the docks.

Aspect.—Dock approaches.—From Penarth head round to Cardiff the coast boundary consists of dock and shore embankments, town and dock walls, and low marsh lands which are covered at very high tides. From Cardiff pier the coast trends north-eastward $2\frac{1}{2}$ miles to Rumney river, which divides the counties of Glamorgan and Monmouth. The situation of Cardiff is low, so that many of its churches and other prominent buildings are intercepted by the masts of its numerous shipping. St. John's church, with a high

tower, stands at the north-west end of the town, about $1\frac{1}{2}$ miles from the docks, with the high tower of Cardiff castle nearly one mile eastward of it.

Banks. — Cefn-y-wrach. — The connected low-water shore between Lavernock point and Penarth dries out about a quarter of a mile, and is composed chiefly of rock and large stones. Abreast of Penarth head lies the Cefn-y-wrach, a bed of stones about 4 cables in extent; its western side, and also a portion of the ledges which dry at low water off Penarth head, has been cut away to form the passage to Cardiff docks, which lies between it and the head.

A mud and rock patch, with 9 feet least water, and 3 cables in extent, lies half a mile south-eastward of the Cefn-y-wrach, and bordering the north-west side of Cardiff road.

The Orchards is a patch of mud and stones about half a mile in extent, situated eastward of Cardiff flats, near the low line abreast the Roath dock; here the dredgings from the dock and harbour channels are deposited, and are partly confined by stakes.

Cardiff and Penarth flats occupy the whole of the bight within the line joining the Orchards to the Cefn-y-wrach, and are about one square mile in extent, with a mud bottom, on which vessels may lie aground, as stated in the remarks on anchorages, page 178.

The outlet of the Rumney is 2 miles from that of the Taff; and with the exception of a gravelly bed at the mouth and small detached patches off it, the low-water feature is mud, drying out about one mile, parallel to the shore.

PENARTH HARBOUR and DOCKS.—Upon the embanked north entrance point of the river Ely, half a mile above the dock entrance, is a wharf with twelve coal tips, in connection with the Taff Vale and Rhymney railways; additional wharves and cranes have also been erected by a Transit and Forwarding Company, with a view to increasing the import trade. This constitutes the tidal harbour of Penarth, to which in the channel of the river, there will not be less than 30 feet at high water ordinary springs, and 22 feet at neaps; and abreast the wharf and tips from 27 to 30 feet at springs, and from 18 to 21 feet at neaps. The cut channel from the road to the harbour and docks has a depth of 35 feet at springs, and 26 feet at neaps.

There is a gridiron and also a patent slip in the harbour; and numerous mooring and warping buoys for the convenience of shipping.

Wet dock.—Penarth dock lies under the north side of the head, and was opened for the admission of shipping in 1865; it is 2,910 feet long, by 370 feet in width, comprising 23 acres, with an entrance of 60 feet, affording a depth over the sill of 35 feet at springs, and 25 feet at neaps. A lock of 270 feet in length by 60 feet in width connects the dock with a basin of 3 acres, which is 400 feet long and 330 feet wide, and having an entrance of the same depth and capacity. Being a tidal dock, the gates can be opened so as to afford a free passage in and out without the necessity of locking. All the gates, ballast cranes, and coal tips, of which latter there are fourteen, each capable of shipping 150 tons of coal per hour, are worked by hydraulic power, and both sides of the dock are in direct communication with the surrounding railway system.

Tidal signals.—From the extremity of the wooden pier on the south side of the dock entrance, is a signal staff, from which a black ball by day and a *white* light at night, denotes that vessels may enter. Vessels intending to enter the dock must exhibit two flags at the main.

Supplies.—Water is obtainable from numerous hydrants in the dock and harbour, and other supplies are readily obtainable from Cardiff or the town of Penarth.

The town of Penarth has made considerable progress during recent years. It is now the favourite place of residence for many Cardiff merchants, whose mansions and villas are prominent objects from the anchorage in the road. It is also much resorted to in summer as a bathing place.

An iron pier 600 feet in length is to be constructed, to facilitate summer steamer communication with the coasts of Devon and Somerset.

Coastguard and Lifeboat.—The coastguard station with life-saving apparatus, is situated on the ridge about half a mile southward of Penarth head; and the lifeboat is kept in a house on the beach just below it. *See also p. 172.*

CARDIFF DOCKS.—The Glamorganshire canal lies on the west side of the town of Cardiff, connecting it with Merthyr Tydvil and Aberdare, and rising to an elevation above the sea lock, over a distance of $25\frac{1}{2}$ miles to the first-named place, of 568 feet. It was opened for the passage of vessels in 1798, being the first dock accommodation which Cardiff afforded. The entrance is by a buoyed cut from the Taff river, and the sea lock is 103 feet long by 27 feet broad, having $18\frac{1}{2}$ feet over the sill at high water springs, and

10 feet at neaps ; over the sill of the inner gates there is a depth of 13 feet and the length of the canal for the discharge and loading of vessels is 5,412 feet, of an average width of 100 feet, in which there is a depth decreasing from 13 to 9 feet. On the east side of the canal there are two small docks for the building and repairs of vessels, and one in connection with the Taff Vale railway.

The river channel to the canal is tortuous ; from the Cardiff cutting it is marked by red buoys which are to be left on the starboard hand, and black buoys on the port ; the least depth will be 21 feet at ordinary high water springs, and 12 feet at neaps, and as the muddy banks are in places very steep, it is necessary to use caution to prevent grounding on either side.

Bute wet docks.—General remarks.—The construction of these extensive works commenced in the year 1835 through the private enterprise and energy of the second Marquis of Bute ; the West dock, the first undertaken, is about 1,000 feet eastward of the Glamorganshire canal, and lies nearly north and south ; this was followed by the East dock of more than double the capacity, parallel to, and 800 feet from the first, and in 1867 the Roath dock was commenced, which with the surrounding land and pier occupy a considerable portion of the muddy flat south of the docks. The first two are filled by the water from the river Taff through the feeder. There is water communication for barges between the upper end of the Bute docks and the Glamorganshire canal, and between the south-east corner of Bute East dock and Roath dock, which latter is by a lock, and adapted for shipping. For depths in the entrance channel, *see* p. 184.

The docks are fitted with every appliance for the rapid discharge and loading of vessels ; some of the steam cranes are capable of lifting 20 tons, and the powerful sheer legs will lift 60 tons.

Roath wet dock is 1,000 feet in length, 550 feet in breadth, 12 acres in area, with a depth of 29 to 39 feet ; the lock communicating with it from the basin, is 600 feet in length by 80 feet in width, with a depth on sill of $35\frac{3}{4}$ feet at high water springs.

Roath basin is 1,000 feet in length by 550 feet in breadth, 12 acres in area, and 29 to 39 feet in depth. The sea lock is 350 feet in length, by 80 feet in breadth, with a depth on sill of $35\frac{3}{4}$ feet at high water springs and 27 feet at high water neaps.

Bute east dock is 4,300 feet in length, 500 feet in width over the greater portion of it, 44 acres in area, with a depth of 25 feet ; the connecting lock with the basin is 200 feet in length by 49 feet in width.

The basin is 380 feet in length by 250 feet in width, and $2\frac{1}{4}$ acres in area. The sea lock is 220 feet in length, by 55 feet in width, with a depth on sill of $31\frac{3}{4}$ feet at high water springs, and 23 feet at high water neaps.

Bute west dock is 4,000 feet in length, by 200 feet in breadth, 18 acres in area, with a depth of 13 to 19 feet; the connecting lock with the basin is 152 feet in length by 36 feet in breadth.

The basin is 300 feet in length, by 200 feet in breadth, and $1\frac{1}{2}$ acres in area; the sea lock is 152 feet in length, by 45 feet in width, with a depth of $28\frac{3}{4}$ feet on the sill at high water springs, and 20 feet at high water neaps.

Graving docks.—There are ten graving docks; see Dock Book for details. A vessel of 4,000 tons and 26 feet draught of water has been docked here.

Landing stage.—Outside the entrance to the Bute docks is a landing stage for steam vessels, &c., where at 3 hours flood, there will be about 15 feet at springs, and 6 feet at neaps.

Low water pier.—From the south-west end of the embankment enclosing Roath basin, a wooden pile pier, called the Low water landing pier, projects with a slight curve for 1,200 feet, with a light tower at the head; there is a railway down to the end of the pier, at which there is a pontoon for the landing and discharge of passengers and goods, together with a lift and crane worked by hydraulic power.

There is said to be a depth of about 5 feet at the extreme of the pier at low water springs, but there is less water in the approach to it as mentioned below.

ENTRANCE CHANNEL TO THE DOCKS.—The entrance channel is an artificial one, cut through the Cefn-y-wrach shoal off Penarth head, straight to Cardiff pier; it has a depth of about 21 feet at half tide; 31 feet at high water neaps; and 40 feet at high water springs.

There is a depth of about 2 feet at low water springs up to Cardiff pier landing, and about the same to the landing places at the entrances to the docks. The eastern side of the channel is marked by red buoys or beacons.

LIGHTS.—From an octagonal white lighthouse at Cardiff pier head is exhibited, at an elevation of 42 feet above high water, a *fixed white* light, visible in clear weather from a distance of 10 miles. Also, from between the entrances of the Bute docks, two *fixed red*

lights, about 23 yards apart, are exhibited; and on the west side of the West dock entrance there is a *fixed white* light.

Tidal signals.—A stemming list is kept by the dock-master, in which masters of vessels are required to enter, prior to docking, the names and registers of their vessels, &c.; a copy of the port regulations may be obtained at same time: vessels are usually admitted into the docks in the order in which their names appear on the stemming list, subject to alterations by the dock master.

No vessel is to approach the docks for the purpose of entering the same unless the signals indicating that she is at liberty to do so are hoisted.

The following are the signals referred to:—

Day signals at dock entrances.—At the entrance of each dock, when there is a free stem and any vessels are allowed to enter, a black ball will be exhibited.

When there is a stemming list and vessels on the list are allowed to enter, a red flag with a white St. Andrew's cross will be exhibited.

When a blue flag is exhibited, no more vessels, whether there be a stemming list or not, are to approach the docks.

Day signals at low water pier.—When there is a free stem for all docks, a black ball at the end of the eastern signal staff, on the long pier extending southward from the docks, known as the low water pier.

When there is a free stem for the West dock, a black ball on the western signal staff.

When there is a free stem for the East dock, a black ball at the western yard of the eastern signal staff.

When there is a free stem for the Roath dock, a black ball at the eastern yard of the eastern signal staff indicates that vessels may come ahead.

When there is a stemming list, a red flag with white St. Andrew's cross exhibited as follows, indicates that vessels on the list may come ahead—

For the West dock on the western signal staff.

For the East dock, on the western yard of the eastern signal staff.

For the Roath dock, at the eastern yard of the eastern signal staff

A blue flag at the masthead indicates that all docks are closed for the tide.

A blue flag on the western signal staff indicates that the West dock is closed.

A blue flag on the western yard of the eastern signal staff indicates that the East dock is closed.

A blue flag on the eastern yard of the eastern signal staff indicates that the Roath dock is closed.

NOTE.—When the blue flag is exhibited for any dock, any vessel, even if on the list for entering that dock and approaching the same, must at once stop and turn back to her anchorage in the road.

Night signals exhibited at the lighthouse at the south extreme of the low water pier, below the main light.

A *red* light indicates that vessels on the list for the West dock may come ahead.

A *white* light that vessels on the list for the East dock may come ahead.

A *green* light that vessels on the list for the Roath dock may come ahead.

Similar lights are exhibited at the dock entrances.

Directions for entering Cardiff and Penarth road are given on p. 179 ; no further remarks are necessary for entering the docks as the vessel would be in charge of a pilot.

Lifeboat.—See Penarth, pp. 172, 182.

Storm signals are made from the Cardiff and Penarth dock flag-staffs, and from the coast-guard station at Penarth.

CARDIFF.—The town of Cardiff is situated on the eastern side of the mouth of the Taff, westward and northward of the Bute docks, with the Great Western Railway station near its centre. Cardiff castle, on the north side of the town, the property of the Marquis of Bute, is of great antiquity, but is kept in excellent repair. Besides the church of St. John, which has a lofty tower, there are many other churches and places of worship. There is here also a county jail, and a guildhall where the assizes are held, a theatre, and numerous schools and charities. Cardiff has grown rapidly since the opening of the Bute docks before referred to (p. 183), and is the chief outlet for the produce of some of the principal mining districts in South Wales.

The population of Cardiff and its suburbs, which in 1861 was 33,000, amounted in 1881 to 128,000.

Supplies of everything necessary for an extensive home and foreign trade can be procured at Cardiff. In the docks, water by hose and floating tank, and boats from vessels in the road can procure water with facility by a hose, when the tide is up, at a little northward of the lifeboat house near Penarth head.

Sailors' home.—Near the Bute west dock is a sailors' home ; a church ship lies in the Bute east dock, and an hospital ship just west of the entrance to the Glamorganshire canal.

Communication.—Trade.—The town and docks are in direct communication with all parts of the kingdom, as well as the surrounding mineral districts, by the South Wales, Taff Vale, and Rhymney railways ; and steam-vessels ply daily to Bristol, and constantly to Ireland and Scotland. In addition to the shipment of coal, iron and steel rails, and ironwork, tin, coke, and patent fuel are exported in considerable quantities ; iron ore and timber from America are the chief imports.

Shipbuilding and repairing in wood and iron are carried on in all branches, as well as the manufacture of anchors, chain, and rope.

The port of Cardiff ranks as the third largest in the United Kingdom for shipping cleared in 1888, which amounted to about 6 million tons register, Liverpool being 8 millions, and London $7\frac{1}{2}$; for the export of coal it ranks as the first port in the world.

The number of vessels arriving at Cardiff often exceed 800 in a month. In the year mentioned between nine and ten thousand vessels entered the port, of the aggregate tonnage of about ten millions of tons ; nine millions exports (chiefly coal), one million imports.

CHAPTER VI.

ABOVE THE HOLMS.—FROM CARDIFF TO KING ROAD, &c.

VARIATION IN 1891.

Flatholm	-	-	18° 40' W.		King road	-	-	18° 30' W.
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THE COAST from Cardiff trends east-north-eastward for 8 miles to the entrance of the river Usk. The land is low and level for a considerable distance back, protected from the sea by embankments. Muddy flats dry out the whole distance for about three-quarters of a mile.*

NEWPORT APPROACH.—**River Usk**, on the west bank of which Newport is situated, has its source in the mountainous borders of the shires of Brecknock and Caermarthen, and for a short distance separates the two counties; afterwards, turning eastward to the village of Trecastle, it flows to the town of Brecon; and with a very winding course south-eastward and afterwards south-west, it passes the towns of Abergavenny, Crickhowell, Usk, and Caerleon to Newport, falling into the Bristol channel 3 miles below the town, its total length being about 70 miles. This river has several tributaries, the chief of which are the Olway, from the north-east, which unites a little below the town of Usk; the Torfaen from the north-west, joining eastward of Caerleon; and the Ebbw, from the same direction, falling into the estuary about $1\frac{1}{2}$ miles within the outlet. The mouth of the river, abreast the lighthouse, is half a mile wide; and above, at the entrance to the docks, about 300 yards.

It is navigable for vessels of deep draught at high water to the docks; there being a depth of 35 feet over the Alexandra dock sill at high water springs, and 25 feet at high water neaps, with rather better water in the river; and there is a depth of about 40 feet over the flats in the entrance to the river from Newport deep. Barges can proceed at high water to Tredonock, 10 miles above Newport bridge.

* See Admiralty chart :—Nash point to New passage, No. 2,682; scale, *m* = one inch.

Banks in the approach.—**Peterstone flats** are the continuation eastward of the shallow flats extending off Cardiff, and occupy the whole of the north side of the approach to Newport. A patch of gravel, with one foot least water, lies half a mile off the edge of low water, westward of Peterstone flats, with Cardiff east buoy bearing W. by S. $\frac{1}{4}$ S., distant $1\frac{8}{10}$ miles; the depths for $1\frac{1}{2}$ miles seaward of this patch are irregular and under 3 fathoms, to within 6 cables of Welsh Hook south-west spit, thence the 3 fathom edge trends towards the Monkstone.

Usk patch lies directly off the river entrance, and eastward of Peterstone flats; it dries at low water springs for a distance of 3 miles in length by 4 cables in breadth; the highest part near its centre dries 25 feet, and lies with Usk river light bearing N.N.W. $\frac{1}{2}$ W., distant $2\frac{1}{4}$ miles; it is connected with the Welsh grounds by a ridge of sand with less than 6 feet water over it.

Welsh Grounds and Hook are described on page 198.

LIGHTS.—From Usk lighthouse, painted white, and situated on the west side of the entrance to the river, is exhibited, from an elevation of 47 feet above high water, *fixed red, white and green* sectors of light, visible in clear weather from a distance of 11 miles on the following bearings:—*White* between N.E. by E. $\frac{1}{2}$ E. and N. by E. $\frac{3}{4}$ E., the latter bearing passing over the extreme of South-west spit in 2 fathoms; *red* between N. by E. $\frac{3}{4}$ E. and N.N.W. *White* from N.N.W. to N.W. by N., or between the two river entrance buoys; and *red* from N.W. by N. to the shore. The *green* sector shows up the first reach of the river, between the bearings W. by S. $\frac{3}{4}$ S. and S.W. by W.

Buoys.—Two buoys on the mud flats, dry at low water, mark the entrance to the river; the western one, a bell buoy painted in red and white vertical stripes, bears S.S.E. one mile from the lighthouse; the eastern, a red conical buoy, lies about $2\frac{1}{2}$ cables E. by S. of it. A second red conical buoy is charted on the edge of the low line at 3 cables eastward of the first, between which are patches of stones dry at low water.

ANCHORAGES.—**Newport deep or road**, between Peterstone flats and the Welsh grounds, is one of the best anchorages above the Holms; it is 3 miles in length in the direction of S.W. by W. and N.E. by E., with an average breadth of half a mile, and depths of 4 to 6 fathoms. The holding ground is red clay, under a surface of sand and mud, with easy tides and little weight of sea.

Coasters may lie aground on the flats between the lighthouse and the bell buoy, and also within the East point of the river.

Tides.—It is high water, full and change, at Newport at 7h. 10m. local, or 7h. 22m. Greenwich time; mean springs rise 38 feet, and neaps 29 feet; the flood stream in the river runs at the rate of about 3 knots.

Pilots and steam-tugs.—Licensed pilots are generally hovering in their boats between Penarth road and the Holms, and are distinguished by the letter N. in their mainsails. No vessel should enter the Usk unassisted, or without a pilot, for the channel is narrow, and the tidal stream rapid; vessels generally tow in and out, for which purpose there are many steam-tugs.

DIRECTIONS.—All dangers in the fairway of the Bristol channel being so well guarded and so easily recognised, previous remarks with reference to the value of minute directions refer also to vessels bound to Newport. The following remarks may, however, be useful, according to the channel taken:—Having followed the directions for approaching Cardiff (page 179) to nearly abreast Flatholm, bring the Monkstone to bear E. by N. and steer for it, which leads northward of Centre ledge. When Flatholm lighthouse bears S.S.W. steer to pass half a mile southward of the Monkstone, thence E. $\frac{1}{2}$ N. for the Grounds light-vessel until South-west spit buoy bears N.E.; then steer for that buoy, passing close westward of it and anchoring in Newport deep if necessary.

Vessels may pass northward of the Monkstone and over the flats when tide permits; there will be not less than 28 feet at half tide as far as the south part of Newport deep, and thence into the river about 21 feet.

At night.—Passing northward of Flatholm, a vessel when eastward of Centre ledge, which will be known by Flatholm light showing *white*, may bring Flatholm light astern on the bearing of S.W. by W. $\frac{1}{4}$ W.; this will lead to South-west spit buoy; when approaching the buoy, by keeping in the *white* sector of Usk light, a vessel will pass westward of the buoy and may anchor, if desirable, in Newport road, or proceed into the river in charge of a pilot.

NEWPORT, as already mentioned, lies upon the west bank of the Usk, about 3 miles above its entrance points; the river abreast the town is about 150 yards in width, and crossed by a bridge of five arches.

Newport is a flourishing seaport and borough, with a succession of wharves and jetties for about 2 miles below the bridge, or to

the Alexandra dock, alongside many of which there are depths of 25 to 35 feet at high water springs; large steam-vessels lie at these piers on a soft mud bottom to discharge and load cargoes. The Alexandra dock pier head has a depth of 36 feet at high water springs, and 27 feet at neaps; the Great Western wharf, abreast the upper end of the old docks, has 29 and 20 feet at corresponding times. For depths in the river, *see* p. 188.

Wet docks.—The Alexandra dock, opened in 1875, is situated about half a mile below the town, and is of the following dimensions:—Length, 2,500 feet, breadth 500 feet, covering an area of $28\frac{3}{4}$ acres, with an entrance lock, having a broad bell mouth, 350 feet in length by 65 feet in width; depth of water over the sills at ordinary spring tides 35 feet, and at neaps 25 feet; the width of the river abreast the entrance being 250 yards. This dock, situated within $1\frac{1}{2}$ miles of the river mouth, is in direct railway communication with the South Wales collieries, including a direct line from the Rhondda valley, and connected with those of all the great railway companies.

A new dock of about the same area as the Alexandra, is in course of construction, south-eastward of the Alexandra; its lock is 550 feet in length by 70 feet in width.

Old dock, situated at the south extreme of the town, and half a mile above the Alexandra, was opened in 1842, and is of the following dimensions:—Length 1,753 feet, the breadth of the outer part 230 feet, the inner averaging 320 feet, and includes an area of $11\frac{1}{2}$ acres; it is entered from the river by a lock 220 feet in length by 61 feet in width, having over the sills an average depth of 31 feet at high water ordinary springs, and 20 feet at neaps; within the dock there is a general depth of 26 feet.

At the north end of old dock there is a paved slip for the discharge of timber, and it is also there connected with the Monmouthshire and Brecon canals.

Graving docks.—There are three graving docks, two of which are entered from the river a little below the old dock entrance; the third, and largest, which is entered direct from the Alexandra dock, is 532 feet in length and 74 feet in width, with a breadth at the entrance of 50 feet, and an average depth of water over the sill of 20 feet. For others, *see* Dock Book.

Repairs.—The fitting and repairing shops erected by the Alexandra dock and railway company, adjacent to the Graving dock, are provided with machinery of the latest types; repairs to both hull and machinery of all classes of vessels are undertaken.

Hospital.—Seamen are admitted to the Newport infirmary, free of charge ; it is supported by voluntary contributions. There is a sailors' home, with mission church attached, and a reading room.

Supplies of all descriptions can be procured, and water from along the docks at the rate of one shilling per 100 gallons.

Trade.—There are manufactories of rope, sails, anchors, and chains, steam-vessels and other machinery, and ship-building is also carried on to some extent. Coal and iron are the chief exports, the former amounted to three million tons in 1888.

The total number of vessels which entered in 1888, amounted to 9,406, of the aggregate tonnage of 2,289,526 tons.

The population of the municipal borough in 1888 was 45,769 ; and the suburbs 10,000.

Lights and signals.—A red flag is shown by day, and a *red* light at night from the flagstaffs at the dock entrances when the gates are open, and a blue flag by day, and *green* light at night, when the gates are closed.

The coast trends south-eastward from the mouth of the Usk for 3 miles, to Gold cliff, a conspicuous walled point, with a farm-house and two out-buildings on its summit. From thence a low shore trends east for $7\frac{3}{4}$ miles to Southbrook Chapel point, near Portskewet, and offers but few distinguishable objects to vessels in the navigable track, which on the average is about 4 miles southward of it. *Continued at p. 209, river Severn.*

SOUTHERN SHORE OF THE BRISTOL CHANNEL.

The description and directions for the southern shore of the Bristol channel will here be resumed from page 82, which included Bridgewater bay and Steephelm.*

BREAN DOWN, the first bold projecting head land to the northward of Bridgewater bay, is a narrow and nearly insulated ridge $1\frac{1}{4}$ miles in length, trending N.W. by W. and S.E. by E., and elevated 305 feet above high water. It is the western of three remarkable ridges nearly equidistant from each other ; the north-eastern is St. Thomas head, with its extreme Swallow point, distant 4 miles ; the centre ridge is Worle hill, and its western extreme is known as Anchor head.

How rocks.—Off the outer end of Brean down, a ledge of rocks, named the How, extends a quarter of a mile ; the tower of Wood-

* See Admiralty charts :—Nash point to New Passage, No. 2,682 and No. 1,157.

spring abbey open westward of Bairnbach island, bearing E.N.E. leads westward of How rocks, but considerable tidal overfalls are formed for some distance beyond it.

Bleadon hill.—Inland, and nearly in the same direction as the ridge of Brean down, is Bleadon hill, elevated 421 feet; upon its south-eastern end is a conspicuous clump of trees, at $1\frac{1}{4}$ miles from which, a little more southward, is Crook peak, the conical hill known as “See-me-not,” a conspicuous object from the offing at times.

WESTON OR UPHILL BAY lies between Brean down and Anchor head, and is 2 miles across, but at low water the whole bay is blocked by mud flats which dry out as far as the centre of Brean down and to the outer extreme of Bairnbach islet.

A patch with 4 feet least water lies nearly half a mile beyond the low line, with the extreme of Brean down bearing S.W. about half a mile.

Axe river.—Close under and to the eastward of Brean down, is the mouth of the Axe. The river, with many windings, leads past the valley of Bleadon, near to the foot of Crook peak, thence southward of Axbridge. About 2 miles within its mouth is a coal wharf, where small coasters discharge coal for the use of the neighbourhood. About three to four thousand tons are discharged in the river annually.

The village of Uphill is situated on Uphill creek, which enters the Axe just within and on the north side of its mouth.

The Axe, is entered by bringing Black rock, which is always above water, to bear S.E. $\frac{1}{2}$ S.; this line must be run upon until within one cable of the rock, which is to be left at the same distance on the port hand; thence in mid-channel. It is only available for coasting craft at high water and with local knowledge; there is a pool within the entrance where small craft can lie afloat at neap tides.

Weston ledge, and buoy.—About 4 cables W. by N. of Bairnbach islet, off Anchor head, is Weston ledge or Honeycomb rock, with a depth of only 2 feet over its shallowest part: its north-west edge is marked by a red conical buoy in 5 fathoms, from which Swallow point bears N.E. $\frac{1}{2}$ E.; and Bairnbach islet E by S. $\frac{1}{2}$ S., distant 5 cables.

Bairnbach islet and pier.—At 2 cables off Anchor head is Bairnbach islet, which is connected with the shore by a pier constructed on iron piles, and from the islet a small pier projects north-

ward nearly to the low-water mark. At the head of this pier there is a depth of 31 feet at ordinary high-water springs, but there are many fishing stakes near it rendering caution necessary when approaching.

Telegraph cable, beacon, and prohibited anchorage.—A beacon, which is an iron column surmounted by a staff and globe, in a line with the square tower of Emanuel church, Weston-super-mare, bearing about E. by S. $\frac{1}{4}$ S., indicates the direction of the submarine telegraph cable for a distance of about $2\frac{1}{2}$ miles from the shore, whence it is laid in a W. by S. direction for 2 miles, passing about one mile southward of Steephelm.* Vessels anchoring in this locality should keep half a mile northward or southward of the above lines of the cable. This beacon is situated in Weston bay, with the Strand hotel bearing S.E. $\frac{3}{4}$ S., distant $1\frac{1}{6}$ miles.

WESTON-SUPER-MARE, the well-known watering place, with its several hotels, is situated in the north-east corner of Uphill bay, directly within Anchor head; the rocky projection named Knightstone, in front of the town, affords shelter at spring tides for coasters, there being a depth of $12\frac{1}{2}$ feet at high water springs. The town is connected with the Bristol and Exeter railway by a loop line, and during summer steam vessels call at the pier to and from Cardiff and Burnham. The population in 1881 was 12,884, and in 1889 about 17,000. From 20,000 to 30,000 tons of coal are discharged in the small harbour, annually, from coasting craft of about 70 to 100 tons burthen; there is no other trade with the place.

The town is sheltered from the north by Worle hill, which is 2 miles in length, having at its eastern extremity a mill, elevated 260 feet, which is a favourite pilot mark for this part of the coast.

Coastguard and lifeboat.—A lifeboat is stationed at Weston-super-mare, where also is a coastguard station.

SAND BAY lies between the Worle and St. Thomas' ridges, the extremes of which are Anchor head and Swallow point, 2 miles apart. Like Weston bay it is entirely blocked by sand and mud flats at low water springs, the low line trending straight from Bairnbach islet to Swallow point; it is therefore useless to navigation.

Anchorage.—Coasters will find anchorage under Swallow point in 6 fathoms, out of the tides, with Walton castle open northward of the point. A ledge of rocks dries a distance of $1\frac{1}{2}$ cables off Swallow point.

* For its continuation westward, towards Ireland, see the charts.

St. Thomas' head, or ridge, is lower than Brean down, but similar in character, and trends east and west for a distance of $1\frac{1}{2}$ miles, having at its southern foot, within Woodspring point, the old Abbey tower of Woodspring. About half way along the ridge, on the northern side, the cliffs break down into a little bay named Middlehope beach.

CLEVEDON.—From Woodspring point a low marshy shore, intersected by numerous streams and small creeks locally termed Pills,* the principal of which is the Yeo, sweeps from a bight to the clifly falls of Wains hill and Salthouse point, in a hollow between which is the old parish church of Clevedon, with a square tower. The whole bight is filled by the Langford grounds, composed of sand and mud, which dry at low water to the distance of one mile from the shore; beyond these are the English grounds, hereafter described; off Clevedon are the Clevedon flats, portions of which are nearly awash at low water. The approach to this portion of the coast is only possible with local knowledge, except when the tide permits a passage over the numerous shallow banks.

Town and pier.—The pretty town of Clevedon, with its terraces and villas, extends along the shore for $1\frac{1}{2}$ miles; about mid-way, or from High cliff under Dial hill, extends an iron pile pier from a buttress of masonry, running out for about 270 yards from the low-water mark, at the head of which there is a depth of about 4 feet at low-water springs, and 23 feet at half tide.

The town is much frequented by summer visitors; and its population in 1881 was 4,869.

Immediately southward of Wains hill is a muddy bight, used by small vessels for the discharge of coal, &c.

LIGHT.—From the head of Clevedon pier, a *fixed red* light is exhibited from an elevation of 27 feet above high water, visible in clear weather from a distance of 7 miles.

WALTON BAY and coast.—From Clevedon pier to Blacknore point the coast has a general trend east-north-eastward for $3\frac{1}{2}$ miles; about mid-way is Walton bay, a bay in name only, marked by a few cottages, and off which is good anchorage for coasters in 3 to 4 fathoms. Between Blacknore point and Portishead point, one mile to the eastward, is Woodhill bay, which dries at about two-thirds ebb. From Portishead point to Portishead pier the coast is straight. The low-water shore does not dry out beyond the distance of one cable, but boats pulling close in to get out of the tide, must be careful to avoid the fishing stakes which form a dangerous obstruction.

* Welsh Pwll.

Weston and Portishead downs.—A ridge, elevated some 300 feet in places, extends the whole distance from Clevedon to Portishead, falling abruptly to the shore. The ruin of Walton castle is upon the western end, and over Portishead are two prominent peaks, on the outer of which, 164 feet high, is a conspicuous flagstaff.

PORTISHEAD TOWN is situated eastward of Portishead down, at about 2 miles westward of the mouth of the Avon, and about half a mile from the capacious wet dock, now the property of the Corporation of the City of Bristol (*see* p. 208 for dock and pier). The town, distant by railway from Bristol about $11\frac{1}{2}$ miles, is increasing in importance, and is much frequented in the summer season; there is an hotel under the hill westward of the entrance to the dock.

Light steam passenger vessels ply daily in the summer to Ilfracombe and other places in the Bristol channel; others from Ireland also discharge passengers and goods at the pier. The population in 1881 was 2,730. Anchorage in the Pool, p. 201.

Portishead to Avonmouth.—Aspect.—From Portishead pier to Avonmouth the coast forms a light; it is low, marshy, and protected by embankments, off which at low-water springs a mud flat dries to the distance of a quarter of a mile; beyond this flat is Firefly and Flatness rocks, described below.

At the mouth of the Avon is Dumball, a marshy islet just above high-water, on which beacons are established as leading marks, p. 200.

Avon lighthouse stands within and southward of it.

On rising ground, $1\frac{1}{4}$ miles south-eastward of Avon light, is Penpole tower, and on a peak of the same ridge, $1\frac{1}{2}$ miles eastward, is Blaize castle, both enclosed by much wood, but easily recognized as leading marks.

Flatness rocks, a bed of gravel and stones, some of which dry at low-water springs, extend out beyond the mud between Portishead and Wharf point for one-third of a mile; the north-west extreme is named the Horse-shoe, between which and Firefly rock is Portishead pool.

Firefly rock, with a depth of 3 feet at low water, lies 2 cables North from Portishead pier, with a narrow passage with from $2\frac{1}{2}$ to 4 fathoms between.

Buoy.—A red conical buoy in 7 fathoms, lies half a cable north of the rock.

Clearing marks.—Blaize castle, in line with Avon lighthouse, leads northward of Firefly rock; the red hut on Dumball islet, in

line with the white hut within it, bearing E. by S., leads northward of Firefly and Flatness rocks, in mid-channel to King road.

At night, *green* lights are exhibited from these huts, p. 200.

KING ROAD AND BRISTOL APPROACHES.*—The **ENGLISH GROUNDS** front the whole coast between Weston-super-mare and Walton bay, a distance of 10 miles, and extend northward for 3 miles into the channel, terminating within a depth of 3 fathoms in North-west elbow and North elbow; the western extreme is Tail patch, with a least depth of 10 feet, and situated W. by N. about 2 miles from Swallow point, or half way in a direct line to Flatholm. A considerable portion of the English grounds dry in patches at low-water springs; the highest are situated about $1\frac{1}{2}$ miles southward of the Grounds light-vessel, and dry from 10 to 12 feet.

THE BRIDGE connects the English grounds with the Middle ground, and within a depth of 5 fathoms is one mile in length, with deeper water east and west of it. The channel over the Bridge is about half a mile wide, with a depth of 4 fathoms (when last examined, 1886), at low-water springs, and $5\frac{1}{2}$ fathoms at low-water neaps on the leading mark, passing close northward of the light-vessel; this is the least water in the fairway between King road and the sea; the Bridge could be avoided by buoying the channel northward of the Middle ground, which has depths of 6 to 8 fathoms, but the above depth is sufficient for most vessels except at near low-water springs. The sands in this neighbourhood are subject to considerable alteration owing to the rapidity of the tidal streams. *See* remarks on the extension of the Middle ground, next page, and tides at pp. 201, 202.

LIGHT-VESSEL.—From the Grounds light vessel, placed on the bridge, at half a mile westward of the north elbow of the English grounds on the south side of the fairway, is exhibited, at an elevation of 38 feet, a *flashing white light, showing a flash every thirty seconds*, visible in clear weather from a distance of 11 miles. A foghorn is sounded during thick or foggy weather, giving *two blasts (high, low) in quick succession every two minutes*; and a gun fired if a vessel be seen standing into danger.

The vessel moored in 4 fathoms, is painted red, with the words *English and Welsh Grounds* on her sides, and carries a ball at the masthead.

* *See* Admiralty chart :—Nash point to New passage, No. 2682, and plan of King road, No. 1859. (Latest information from Staff-Commander W. E. Archdeacon, in charge of Admiralty Survey, 1883-6.)

From the light-vessel, Flatholm lighthouse and the North-west elbow of the grounds bears W. by S. $\frac{5}{8}$ S., the latter $1\frac{1}{2}$ miles distant; Usk lighthouse, N. $\frac{3}{4}$ E., distant $5\frac{1}{2}$ miles, and Portishead point, E. $\frac{1}{4}$ N. $7\frac{3}{4}$ miles.

Fairway.—In the absence of the light-vessel, Portishead hill (south-east of the point), kept in line with the cottage on extreme of Blacknore point, bearing East, leads over the Bridge in 4 fathoms at low-water springs.

MIDDLE GROUND lies between the English grounds and the Welsh hook, and within the depth of 3 fathoms is 3 miles in extent, and parallel to the latter. It varies in breadth from 2 to 6 cables, and its shoalest part, near the centre, dries 2 feet at low-water springs.

It was found, in 1888, to have extended to the south-westward, and to have grown up considerably near its centre since 1886, the date of the survey; it is said to be extending both eastward and westward, rendering it advisable for vessels to keep to the buoyed fairway.

Buoys.—Middle ground is marked on its southern side by 3 buoys:—

West Middle ground is a can buoy, painted in red and white vertical stripes, placed on the south-west extreme of the bank in about 3 fathoms, with the Grounds light-vessel bearing S.E. by E., distant three-quarters of a mile, and Usk light N. by E. $\frac{1}{3}$ E. distant $5\frac{1}{3}$ miles.

South Middle ground is a red and white chequered can buoy, placed in about 3 fathoms abreast the centre of the bank, with the Grounds light-vessel bearing S.W. by W. $\frac{1}{4}$ W., $1\frac{1}{4}$ miles, and West Middle ground buoy W. $\frac{1}{2}$ S.

East Middle ground is a can buoy, painted red and white in vertical stripes, in about 3 fathoms, placed on the south edge of a 3-fathoms patch at the east extreme of the bank; it lies with the South Middle ground buoy, bearing W. by S., distant $1\frac{1}{2}$ miles, and Usk lighthouse N. by W. $\frac{3}{4}$ W., distant 5 miles.

WELSH GROUNDS, connected with the northern shore from Newport to New passage, occupy fully two-thirds of the water space of the head of the Bristol channel; on an average, they dry out for about 3 miles, and are 12 miles in length. The south-west extremity, known as the South-west spit (which in 1847 was a detached shoal separated by a channel of from 2 to 4 fathoms), is a sharp prong, bold-to on both sides, extending from that portion of the sand named Welsh hook; its north-western edge trends in a straight line towards Gold cliff, or N.E. by E. for 4 miles; thence eastward it is connected by a

sand ridge with less than one fathom water with Usk patch. Its southern edge, from South-west spit buoy to Welsh hook buoy, is concave, with depths of 6 to 8 fathoms close-to ; thence it trends parallel to the south shore, distant one mile, to abreast Portishead ; here a prong projects about half a mile to the south-westward, known as the Newcome shoal, from whence the bank trends straight to Portskewet.

The highest part of the Welsh grounds, situated about 4 miles above the South-west spit, and abreast Clevedon, is near the southern edge, where it dries to a height of 27 feet at low-water springs, or over which at high water there is a depth of 11 feet.

Steam-vessels between Bristol and Newport cross the sands a little westward of Denny islet when the state of the tide admits ; at high-water springs there is a depth of about 30 feet.

Buoys.—The **South-west spit buoy** lies in $4\frac{1}{2}$ fathoms at the western tail of the sands ; it is conical, painted black, and surmounted with a staff and ball, with Usk lighthouse bearing N. by E. $\frac{3}{4}$ E., distant $4\frac{1}{2}$ miles, and West Middle ground buoy S. by E. 8 cables.

Welsh Hook is a can buoy, chequered red and white, in $4\frac{1}{2}$ fathoms, close to the south elbow of the bank, with Blacknore point bearing E. by S., distant $2\frac{2}{10}$ miles, and South Middle ground buoy bearing West.

Newcome buoy, can-shaped, and painted red and white in vertical stripes, lies in $3\frac{1}{4}$ fathoms on the southern edge of the prong, with Portishead point bearing S.W. $\frac{1}{4}$ S., distant 6 cables, and Welsh hook buoy W. $\frac{1}{4}$ S. Newcome shoal is constantly shifting, and the buoy should be given a wide berth.

The Denny is a remarkable rock 21 feet above high water, and 400 feet in length, situated on the Welsh grounds at about 2 miles northward of Portishead point ; it is a useful mark for fixing by bearings when approaching King road.

Cockburn rock.—Eastward of Newcome shoal, in the entrance to King road, shallow flats, with less than 3 fathoms water, lie scattered between the Welsh grounds and Avonmouth ; one near the middle, and forming the northern boundary of King road, is $1\frac{1}{4}$ miles in length, having several patches with depths ranging from 4 to 12 feet at low-water equinoctial springs ; Cockburn rock, with 4 feet water, is the shallowest ; it lies 4 cables from the western end of the flat, with Avon light bearing S.E., distant $1\frac{3}{10}$ miles.*

* See footnote on reduction of soundings, page 202.

Buoy.—A can buoy, red and white chequered, is placed in about 4 fathoms $1\frac{1}{2}$ cables S.E. by S. of Cockburn rock, with Avon lighthouse bearing S.E. $\frac{1}{2}$ E., distant $1\frac{1}{2}$ miles.

LIGHTS.—Avon lighthouse, on the east side of entrance to the Avon, is an octagonal white tower with the keepers' dwellings attached on both sides.

An *occulting white* light (that is to say, once in every half-minute the light suddenly disappears for three seconds, and then as suddenly re-appears at full power), elevated 73 feet above high water, is exhibited seaward, visible in clear weather from a distance of 14 miles.

A narrow *red* sector is shown over King road in the direction of the entrance channel to the river, or Avon lighthouse in line with Penpole tower bearing S.E.; vessels anchoring should anchor eastward of this red sector, in order to leave the passage to the river clear.

A strip of *green* light will be seen when in the river between the bearings of East and E. by N., at the turn of the channel.

A *fixed white* light is exhibited all night from the outer extreme of Portishead pier (page 208), under the control of the Great Western Railway Company.

Leading lights and beacons.—A *fixed red* light, 18 feet high, is placed 230 yards north-west of Avon light; these lights in line lead into the river.

From a red hut situated on the west side of Dumball island, and a white hut on the main 750 yards E. by S. of it, *green fixed* lights are exhibited. The huts kept in line by day, and the lights at night, lead into King road between Cockburn rock and Flatness rocks.

For dock, tidal lights, *see* page 208.

Upon Dumball island are two wooden beacons, which in line lead through the short reach of the river within Avonmouth dock, marked by a *green* sector at night as before stated.

ANCHORAGES.—From the Holms, north-eastward to Newport deep, large vessels may find tolerably secure anchorage, along the outer edge of the flats eastward of Cardiff grounds and of Peterstone flats, upon which flats, close to the main channel, there is as little as $2\frac{1}{2}$ fathoms, over hard ground, dropping down into 6 to 8 fathoms, clay or mud. Within 4 miles north-eastward of Flat-holm, its lighthouse should not be brought to bear southward of W.S.W., beyond that distance Goldcliff may be brought to bear N.E. by E. $\frac{1}{4}$ E.,

or on with the present position of South-west spit buoy ; but as these marks are often indistinct, and the edge of the flats is steep-to, the lead must mainly be depended on.

Above the Grounds light-vessel, the next anchorage out of the fairway is Walton bay, where good shelter can be had with but little tidal stream, in from 3 to 4 fathoms, about $1\frac{1}{2}$ to 2 cables off shore. Good water can be procured from a spring close under the low cliffs in the bight abreast the anchorage.

King road, the temporary but safe anchorage for vessels bound into the Bristol docks, has depths of 4 to 6 fathoms, chiefly mud bottom, but the tides run from $4\frac{1}{2}$ to 5 knots at springs. Between the 3-fathom edge of the Cockburn flat and a similar depth off the Avonmouth flats, the road varies from 2 to 3 cables in breadth.

It lies off the mouth of the Avon, 17 miles above Flatholm, and 10 miles above the Bridge, which has a least depth of 4 fathoms at low water springs, the least depth between King road and the sea ; but the Bridge, however, presents little or no hindrance to large vessels entering or leaving at any time.

The limits of the anchorage in King road usually taken up, is about half a mile on either side of a S.E. bearing of Avon lighthouse in line with Penpole tower, which bearing at night, is marked by a *red* sector of the Avon light.

Portishead pool or Horse-shoe, chiefly adapted for coasters, is off Portishead pier, between Firefly and Flatness rocks, with depths of 2 to 4 fathoms. Portishead pier lighthouse, bearing S.S.W., leads in eastward of Firefly rock to anchorage in about 3 fathoms, but this mark is athwart the tide ; the channel southward of Firefly rock is to be preferred, bearing in mind that the buoy guards the rock on its north side only.*

North eastward of Firefly rock there is anchorage in $4\frac{1}{2}$ fathoms at low-water, but with stronger tide, with the church and customhouse in line, and the Avon lighthouse on with the extreme of Wharf point bearing E. by S. $\frac{1}{4}$ S. ; the holding ground is good.

Tides.—It is high water, full and change, at Portishead or King road at 7h. 13m. local, or 7h. 24m. Greenwich time ; ordinary springs

* *Caution.*—The training ship *Formidable* is moored head and stern, close to the low-water edge, about 2 cables above Portishead pier : she has five anchors down, three to seaward, and two on the mud flat. The latter, with that from ahead, have above 300 fathoms of chain out, those to the northward about half that quantity ; caution is therefore necessary by all vessels seeking shelter in the pool or intending to ground, not to foul these cables. The anchors are each marked by small log buoys.

rise 40 feet,* and neaps 31 feet; neaps range 22 feet. The mean hourly rise of a spring tide is, for the first hour, 6 feet; second hour, 8 feet; third hour, $9\frac{3}{4}$ feet; and of a neap, first hour, $1\frac{1}{2}$ feet; second hour, $3\frac{1}{2}$ feet; third hour, $4\frac{1}{4}$ feet; fourth hour, $4\frac{1}{2}$ feet.

Tidal stream.—The general strength of the tidal stream in the channel, from the Holms to the Grounds light-vessel, is $3\frac{1}{2}$ knots on a spring flood, and 4 knots on the ebb; from abreast Walton bay upwards, the rate is from $4\frac{1}{2}$ to 5 knots on springs, the neap tides being about 2 knots less; much, however, depends on the height of the banks above water, and in the narrows, upon the river freshes. The direction of the flood from Flatholm is towards South-west spit of the Welsh grounds, near which it spilt, one part setting rapidly over the tail of the shoal towards the Usk, the other fairly up the channel to King road, the greatest strength being experienced along the north side of the channel. The ebb sets fairly down until abreast the Welsh hook, when it sweeps over the English grounds with considerable velocity until the tide has fallen and becomes more confined to the channel fairway, running out until 50 minutes after low water by the shore. When the sands are covered, caution is necessary to prevent vessels being set over the Welsh grounds, especially eastward of Welsh hook buoy, where the sands are low and shifting.

Pilots and steam-tugs.—The Bristol pilot vessels are numerous, and will be recognised by the numbers being on their bows, and without letters on the sails; they will be found in every part of the channel down to Lundy island. The pilots are licensed by the corporation of Bristol, and the pilotage within the port of Bristol, which extends down to the Holms, is compulsory to vessels of the Mercantile Marine.

Steam-tugs will always be found at anchor, or hovering about in the usual track of vessels.

DIRECTIONS.—Approaching King road.—The dangers in the Bristol channel are now so well and simply marked by the uniform system of buoyage adopted by the Trinity House, supplemented by numerous powerful lights, that little difficulty is experienced by the seaman in navigating his vessel from sea to the Holms, or even, in clear weather, to King road; and it should be remembered that, owing to the great rise of the tide, many of the dangers bordering the fairway, which appear formidable on the

* The soundings and low-water feature of King road plan are reduced to the level of equinoctial springs, or 2 feet below ordinary springs.

chart, disappear as the tide rises, there being at half-flood nearly 20 feet greater depth than is shown on the charts. However, as pilotage for the port of Bristol, which extends down as far as the Holms, is compulsory to vessels of the mercantile marine, it is advisable for those vessels to pick up their pilots in the neighbourhood of the Holms. The Bristol pilot boats (page 202) cruise in the Bristol channel as far down as Lundy island, so that no difficulty will be experienced in obtaining one whenever desirable. Should the weather come on thick, vessels will find convenient depths for anchoring anywhere eastward of the meridian of Swansea; but it must be borne in mind by those anchoring in the fairway that whole fleets of colliers and others are undocked from the ports above at every high water, outward bound, and that attention to fog-signals is imperative. During easterly or westerly gales Lundy island offers secure shelter. As before stated, the navigation is easy in fine and clear weather by running from buoy to buoy; but the following remarks may be useful for proceeding to King road.*

Proceeding to King road between the Holms, passing southward of Breaksea light-vessel, and between it and Culversand, the fairway mark is Anchor head a little open southward of Steepholm (as mentioned on page 81) bearing E. $\frac{1}{2}$ S. This leading mark should be kept until east Culver buoy bears about S.S.E., when alter course to E. by N. $\frac{1}{2}$ N., to pass midway between the Holms. From abreast Flatholm, alter course to N.E. by E. $\frac{1}{2}$ E. for west Middle ground buoy, gradually bringing Flatholm lighthouse astern, bearing W.S.W. as the north-west elbow of the English grounds is approached; and when the Grounds light-vessel bears East, steer to pass just northward of it, with Portishead hill on with Blacknore cottage bearing East; this latter mark leads over the Bridge in about 4 fathoms at low water springs (an hour after which there will be 6 feet more water), and $5\frac{1}{2}$ fathoms at low water neaps, and up to Blacknore point. Thence to Portishead keep about one-third of a mile off shore, passing well southward of Newcome buoy; the red hut on Dumball island in line with the white hut in rear of it bearing E. by S. leads into King road clear of danger.

A vessel may anchor when Portishead pier lighthouse bears S.W. by W. $\frac{1}{2}$ W., or then proceed E. by N. until Avonmouth light-house bears southward of S.E., which will be out of the track of vessels leaving the Avon.

* Directions for approaching the Bristol channel are given on pp. 3, 4; thence for passing northward of Breaksea light-vessel and Flatholm to Cardiff, on p. 179, and from abreast and northward of Flatholm to the Grounds light-vessel and Newport, p. 190.

At night.—Bearings of the Nash, Breaksea, and Flatholm lights will ensure the position of the vessel as far up as midway between the Holms; thence, as before, steering N.E. by E. $\frac{1}{2}$ E., gradually bringing Flatholm light to bear W.S.W. astern, and keeping it so until the Grounds light-vessel bears East; then steer to pass just northward of it, and gradually bring it to bear West, astern; keeping it so will lead nearly up to Blacknore point, which with Portishead point should be passed from 3 to 4 cables distance, whence the *green* light on Dumball island kept in line with the *green* light in rear of it, bearing E. by S., will lead into King road, when anchor if necessary, when Portishead pier light bears S.W. by W. $\frac{1}{2}$ W.; or from that position steer E. by N. until northward of the *red* sector shown from Avon light on a S.E. bearing, which will be out of the track of vessels from the Avon.

Caution.—The above directions are given for steam vessels or sailing vessels with a leading wind. For sailing vessels working up, there is little or no danger westward of the Holms if proper care is exercised; but above them, except at near high water, the navigation is not quite so easy, and it must be remembered that the tides run with great strength at springs varying from 3 knots near the Holms to 5 knots in King road. The use of the lead in no case should be dispensed with.

THE PORT OF BRISTOL.

Limits of the port.—The port and harbour of Bristol extends from Hanham mills on the river Avon to King road, at the mouth of the river, thence down the Severn and Bristol channel to Flatholm and Steepholm, known locally as the Holms.

As before stated, vessels can reach King road at all times, with the exception of perhaps half an hour's delay at the Bridge (p. 197) at low water springs, 10 miles below, for vessels of and above 24 feet draught. The depths in the Avon to Bristol docks are given on p. 205.

RIVER AVON has its rise near Tetbury on the borders of Wiltshire and Gloucestershire; it passes Malmesbury, Chippenham, and Bradford, where, besides other tributaries, it receives the Frome from the south; it flows by the north of Bath and Keynsham, receiving at the latter town the Chew from the south-west, and dividing the counties of Somerset and Gloucester, arrives at the city and port of Bristol. Here the river passes through an artificial cut south of its original bed, which was converted into a harbour or wet dock (p. 206); it resumes its old channel at the Hotwells, running between the steep cliffs of St. Vincent rocks, and with one

sharp bend near Shirehampton joins the Severn $1\frac{1}{2}$ miles above Portishead, the total length from its source to Bristol being 74 miles, and to the mouth of the river 80 miles. The course was formerly eastward of Dumball island, but that channel no longer exists, and the present outlet is now westward of it, where between the points at high water it is 3 cables in width : at low water ordinary springs the depth is about 3 feet. A dredger is employed here when necessary.

Depth to docks.—In the Avon entrance there is a depth of at least 40 feet at high water springs, and 31 feet at high water neaps, with 33 feet and 24 feet on the Cumberland lock sill at the corresponding times ; but there is apparently less water in places in the river. The Bathurst lock sill has depths of 22 feet at high water springs and 13 feet at high water neaps ; beyond which the Avon is navigable for barges to Noetham dam, $2\frac{1}{2}$ miles, the tide flowing to Hanham mills, 5 miles above the basin.

Steamers of a maximum length of 320 feet and $22\frac{1}{2}$ feet draught, can reach the docks at springs, but shorter vessels, like timber ships, may be taken up drawing 24 feet. Vessels are not taken up with less than 5 feet water under their keels.

Pill, or Crocker pill, is on the left bank of the Avon, across which there is a ferry to Shirehampton village, one mile above its mouth. The village is chiefly inhabited by pilots and other seafaring men, and there is a small dock for building and repairing boats.

BRISTOL.—The city of Bristol, situated on the right bank of the Avon, $6\frac{1}{2}$ miles from its mouth, is bounded on either side by Gloucestershire and Somersetshire, and is of ancient date and importance. It stands on very irregular ground. Brandon hill is elevated 259 feet ; Clifton, a western suburb, above 300 feet. The river or New cut is crossed by railway and road bridges ; also by the suspension bridge across the St. Vincent rocks at Clifton, the span of which is 637 feet, and the roadway elevated 545 feet above high water ; this remarkable structure was opened in 1864.

The position of Bristol, situated as it is at the head of the Bristol channel, which extends far towards the middle of the southern portion of England, gives the port enormous advantages as the centre from which sea-borne commodities can be most cheaply distributed to the Midland districts, and from which shipments from those districts can be most cheaply made, and since the completion of the Severn tunnel, coal can be supplied almost as cheap as from the shipping ports of South Wales. The Parliamentary borough returns four members to the House of Commons, and the estimated population within the boundary in 1886, was 253,000.

Trade.—The manufactories of Bristol are extensive ; the most important are those of brass, copper, zinc, lead, soap, and shot ; there are also iron foundries and sugar refineries, and a certain amount of shipbuilding is carried on. The inland trade is chiefly by the Great Western, Midland, Bristol and Exeter, and South Wales Union railways. There is also a short line along the north side of the river to the Avonmouth dock ; and, another branching off the Bristol and Exeter along the south bank to Pill and Portishead dock.

The aggregate tonnage of vessels entering the port Bristol in 1888, amounted to 1,296,000 ; this includes Avonmouth dock, 237,000 tons, and Portishead dock 99,000 tons.

Imports.—Bristol early possessed a large share of the trade with the United States and West Indies, of late years she has absorbed considerable trade with the East Indies, Black sea, and the American grain trade. Also large quantities of oils, marble, ores, seeds, green and dry fruit, &c., are imported from the Mediterranean, provisions from the United States and Canada, hides and tallow from South America and the Baltic, timber and deals from the north of Europe, sugar from East and West Indies, and petroleum from the United States and Russian ports.

Exports, consist chiefly of Welsh and local coal, salt, tin plates, railway material and machinery, manufactured oils and spirits, cotton goods, chemical products, and general merchandise.

Steam communication.—There is almost daily steam-vessel communication between Bristol and the principal ports of Wales and Ireland. Several lines of steamers trade to the French, Spanish and Mediterranean ports, and to the United States and Canada, &c.

HARBOUR AND DOCK ACCOMMODATION.—The dock system belonging to the corporation of the City of Bristol comprises the city wet docks, within the city of Bristol ; the Avonmouth wet dock, at the mouth of the Avon ; and the Portishead wet dock, 2 miles below Avonmouth, besides five or more dry docks, the largest of which has a depth of $14\frac{1}{2}$ feet on its sill.

The docks are all worked under the direction of a committee of the town council, elected annually ; the committee is also charged with the general supervision of all pilotage and conservancy matters connected with the port of Bristol.

City wet docks, as before mentioned, were formed by the conversion of about 3 miles of the ancient bed of the river into a

harbour, or wet dock, including also a portion of the Frome, which enters the city from the north-eastward; it is supplied with water from the Avon by a feeder above the dam at Noetham, and was opened for shipping in 1809. (The new or compensating river, made southward of the city, extends from Marsh bridge to Rownham ferry, near the Hotwells, a distance of 2 miles, and is 200 feet in width).

The harbour, or wet dock, thus formed, comprises about 63 acres of water space, 7,500 yards of wharfage, with depths alongside varying from 15 to 25 feet, close to the warehouses in the heart of the city. It is crossed by several bridges, and is connected with the river by the sea locks of Cumberland and Bathurst basins. Cumberland basin, the principal entrance, is a half tide basin, with a depth of 28 feet water maintained at all times, and 33 feet over its sill at high water springs; the sea lock is 350 feet in length by 62 feet in width, with a depth of 35 feet on sill at high water springs, and about 25 feet at high water neaps. Bathurst basin lock has 22 feet over its lock sill at high-water springs, and 13 feet at high-water neaps. There are several graving docks, &c., for which *see* the "Dock Book."

On the harbour wharf is a crane capable of lifting 35 tons; there are numerous other cranes, and every steam appliance for the rapid discharge and loading of vessels.

Sailors' Home.—There is a sailors' home near the city docks.

Drill ship.—H.M.S. *Dædalus*, a drill ship for the Royal Naval Reserve is stationed at Bristol.

Avonmouth dock, opened in 1877, is situated at the mouth of the river Avon, about three-quarters of a mile from the anchorage of King road. The approach to the lock forms a tidal basin 350 yards in length, of an average width of 70 yards, with a depth of 40 feet at ordinary spring tides. The lock is 454 feet long and 70 feet wide, with a depth over the outer sill of 38 feet at ordinary spring tides, and of 29 feet at ordinary neap tides. The dock is 1,400 feet in length, 500 feet in width, an area of 16 acres, and 1,200 yards of wharfage accommodation; the depth of water maintained is 26 feet.

The eastern quay is furnished with two travelling hydraulic and three hydraulic cranes, each capable of lifting 35 cwt.; on the western quay there is a 15-ton hydraulic crane for the purpose of lifting machinery and other heavy goods, also one 5-ton and two 3-ton portable cranes, all of them adapted for loading or discharging goods with the utmost dispatch. Warehouses, cattle sheds, and slaughter houses have been constructed on the dock quays, and there is direct communication with the whole of the railway systems of the kingdom.

Tidal lights and signals.—One black ball or cone by day, or a *green* light at night, shown from the yardarm of the flagstaff at Avonmouth dock entrance, signifies that the gates are open and the channel clear for vessels to come in. Two black balls or cones by day, or a *red* light at night, signifies that the entrance is foul, and that incoming vessels must remain in King road.

A *green* light marks the south point of lock entrance, and a *red* light the north point, or port hand, for the guidance of vessels entering. When neither balls or lights are exhibited, the gates are closed. For other lights *see* page 200.

Portishead wet dock.—Close to the eastward of Portishead upper point, the pill or inlet has been converted into a wet dock, 1,800 feet in length and 500 feet in breadth, affording an area of 12 acres, and 600 yards of wharfage accommodation; the entrance is through a lock 450 feet in length by 66 feet in breadth.

Over the outer sill of this lock there is a depth of 33 feet at high water springs, and 24 feet at neaps. The inner sill of the lock is 6 feet above the outer sill, but the water in the basin is kept at a level of 25 to 28 feet above this sill, by means of the small river discharging into the upper part of the dock. Storage is provided alongside the dock, and the railway waggons may be loaded under cover direct from the ship.

Fresh water is laid on to all parts of the dock and pier.

Vessels can enter and leave the dock in almost any weather, and steamers enter and leave the dock without the assistance of a tug.

Pier.—Portishead pier is formed by a stone jetty projecting 400 feet north-eastward from the west side of the entrance to the dock, with an extension of 550 feet on piles in the same direction; it dries about 3 feet at low water springs, but has a depth of about $1\frac{1}{2}$ feet at low water neaps, and 17 feet at half tide. For light *see* page 200.

Tidal lights and signals.—One black ball or cone, by day, or a *green* light at night, shown from the yardarm of the flagstaff at Portishead dock entrance, signifies that the gates are open, and the channel clear for vessels to come in.

Two black balls or cones by day, or a *red* light at night, signifies that vessels are being locked out, that the entrance is foul, and that incoming vessels must remain in King road.

A *white* light is shown on each side of the entrance to the lock, and a similar light at the head of the dock as leading lights; the latter to be kept midway between the others.

When neither balls or lights are exhibited, the gates are closed. A *fixed white* light is exhibited from the outer end of Portishead pier from sunset to sunrise, as stated on page 200.

Directions are given for King road at page 202; no directions are necessary or advisable for entering the Avon, or the docks, as the vessel will be in charge of the pilot or dock authorities.

RIVER SEVERN, second only to the Thames in England, takes its rise high in Plinlimmon, on the south-western borders of Montgomeryshire, 1,500 feet above the sea level; 11 miles from its source it reaches the town of Llanidloes; flowing from thence north-east by Welshpool for the great plain of Shropshire, and after making a wide circuit turns abruptly to the south-east for the town of Shrewsbury, 72 miles, which it nearly surrounds. Upon the same course the river passes Coalbrookdale, and then more southerly, Bewdley and Stourport, there joined by the Stour from the north, and several canals from the surrounding trading towns; 13 miles below, or $62\frac{1}{2}$ miles from Shrewsbury, it passes the city of Worcester on the west, and enters the town of Gloucester at Tewkesbury, and in a south-west direction reaches the second cathedral city, distant 30 miles. From Gloucester to Sharpness the course of the Severn is very serpentine and irregular; 12 miles below the city, at Framilode, it receives the Frome or Stroud from the eastward, and making a remarkable horse-shoe bend of 9 miles, it becomes a tidal estuary of varying breadth to its junction with the Bristol channel at King road, the total distance to which, from its source, is 220 miles.

The river is navigable to Sharpness for vessels that can enter the wet dock there, which has a depth of 24 feet on its sill at high-water springs, and 14 feet at high-water neaps, page 213. The channel of the Severn river above Sharpness, to Gloucester, is dangerous and uncertain, and only used by small craft at near springs; but, vessels of 15 feet draught can proceed by canal to Gloucester, page 215. Above Gloucester, by means of artificial weirs and locks, it is navigated by craft up to 80 tons along different portions to as far as Pool quay, near Welshpool in Montgomeryshire, $31\frac{1}{2}$ miles above Shrewsbury. The Stroud water canal from Framilode, connecting the Severn with the Thames, was completed in 1792 when the first craft passed through.

Vessels of 10 to 12 feet draught can lie afloat in the Wye off Chepstow (p. 212); deeper draughts must lie aground in the mud. There is a depth of about 46 feet at high-water springs, and 36 feet at high-water neaps, as far as Chepstow.

Pilots and steam-tugs.—The Severn pilot boats are both cutter and yawl-rigged, with the letter G upon their sails; they cruise down as far as Lundy island. There are steam-tugs for river service, and vessels usually tow up and down, the time required being about 3 hours to Sharpness from King road; and through the canal to Gloucester, a working day.

Directions.—Vessels bound up the Severn for Chepstow, Lydney or Sharpness, usually weigh from King road at 2 hours flood. On account of the rapidity of the tides (page 216) and the shifting nature of the sands; it is not advisable to attempt to navigate above King road without the assistance of a pilot. The following small lights have recently been set up (1890) to assist the pilots in night navigation.

Lights.—A *revolving white* light on Charstone rock, off Portskewet; a *fixed white* light on Mathern cliff, north-eastward of it; these in line lead from King road through the Shoots, as mentioned on page 211.

A *fixed* light on Chapel rock, entrance to the Wye, *white* in fairway, *green* on either side.

A *fixed white* light on Inward point to indicate the position where vessels enter or leave the Counts or Barnacle channel.

Two *fixed white* lights at Shepperdine, just north of Chapel house, as leading lights for the Counts channel.

A *fixed* light abreast Hayward rock; it shows *red* over the rock, and *white* on either side of it.

Two *fixed* lights at Conigre pill, just south of Berkeley pill; these in line, showing *white*, lead northward of Hayward rock, and in the best channel over the flats; the front light shows *green* when approaching Bull rock, and the back light *red* when abreast that rock.

Two *fixed white* leading lights at Sharpness; one on the pier at entrance to dock, the other on the bank; these in line lead northward of Bull rock.

A *fixed red* light is shown from the centre pier of the Severn bridge, between the two wide arches, and a *fixed white* light at the landward extremity of each wide arch, visible both above and below the bridge.

A *fixed white* light on Lydney pier.

NEW PASSAGE AND PORTSKEWET.—At 5 miles above Avonmouth the Severn contracts to $1\frac{1}{2}$ miles in width between New passage and Portskewet. From 1863 to 1888, or until the Severn tunnel was completed, there was steam ferry communication in

connection with the Bristol and South Wales Union railway ; it is now discontinued and the piers have been removed.

Charstone rock, the top of which seldom covers, is situated about 3 cables off Portskewet, on the tail of the low water flat extending south-westward from the entrance to the Wye, $1\frac{1}{2}$ miles above. *See light*, p. 210.

Dun sand, about $1\frac{1}{2}$ miles in length, dries about 15 feet at low water springs, and lies in mid channel between Portskewet and Aust head ; it is connected with the flats extending off the Wye by a bank with about one fathom over it at low water.

Old passage.*—Chapel isle and ruin are situated off Beachley point, the east point of entrance to the Wye. Between Beachley point and Aust head is Old passage, less than a mile across. At low water it is much obstructed by rocks ; the Ulverstone and Black rocks extend a quarter of a mile off Aust head ; the Larry, upper and lower Bench in mid-channel, and the Lyde, Dodd and Dodd sand, which extend a quarter of a mile off Beachley point. There is a channel on either side of the Benches.

Directions.—Charstone rock, *revolving white light*, kept in line with the *fixed white light* on Mathern cliff above Portskewet, leads up from King road through the Shoot passage ; this passage is reduced to $1\frac{1}{2}$ cables in width between the English stones and the Mixons ledges. Close eastward of Charstone rock, between it and Dun sand, there is anchorage in 6 to 12 fathoms. The river above Portskewet is only available with local knowledge ; thence to the mouth of the Wye there is about 4 feet at low water, p. 212.

Coasters occasionally anchor below Aust head, where there is a depth of from 4 to 7 fathoms ; the safest place for lying aground is Mathern oaze, a little above Portskewet.

RIVER WYE AND CHEPSTOW.—The Wye rises on the southern side of Plinlimmon mountain in Montgomeryshire, about 2 miles from the source of the Severn, and flowing 19 miles south-eastward to Rhayadegwy, flows from thence by Builth to Hay, 36 miles, the boundary between Radnorshire and Brecknockshire. Twenty-eight miles beyond it reaches the city of Hereford, and, with a very circuitous channel of $26\frac{1}{2}$ and 19 miles, the towns of Ross and Monmouth respectively. The river is here joined by the Monnow, having previously been swelled by numerous tributaries. Separating the counties of Monmouth and Gloucester, it flows by Redbrook and under the Bigsweir bridge, of 160 feet span, on to Chepstow, 18 miles,

* *See plan of Old passage*, No. 1,745.

passing the famed ruin of Tintern abbey, and between the abrupt cliffs and steep wooded falls. From Chepstow to the junction of the river with the Severn, the distance is 2 miles, and the whole length from its source, to the mouth which is three-quarters of a mile wide, is 149 miles.

The tide occasionally reaches as far as Redbrook, where barges discharge their cargoes, but boats navigate the river nearly to Hay in Brecknockshire a distance of 90 miles.

Chepstow is upon the right bank of the Wye, and the magnificent ruins of its castle, occupying 3 acres of ground, are upon the summit of a cliff whose base is washed by the river. The town is connected to the Midland Counties, South Wales, and London, by the South Wales railway, which crosses the river by means of a bridge designed by Brunnel, and opened in 1852, combining the principle of Telford's suspension and Stephenson's tubular bridges. The tube which spans the river is 300 feet in length and 9 feet in diameter, with a clear water-way of 51 feet above the highest tide, and 94 feet above low water, while the bridge altogether is 600 feet in length. The river is also crossed at the town by an iron bridge opened in 1816; it is on piers of masonry, having a centre arch of 112 feet span, two arches of 70 feet, and two of 34 feet; the total length of the bridge being 372 feet.

Depths.—There is a depth of about 46 feet in the river to Chepstow at high-water springs, and 36 feet at high-water neaps, as stated on page 209.

Pilots.—Directions.—A pilot is necessary for Chepstow, unless locally acquainted. Gloucester pilots also act as pilots for Chepstow; vessels bound there generally weigh from King road at the first of the flood, when most of the dangers are visible. The leading mark for the Shoot passage, through which the tide runs with great rapidity, is given on pp. 210, 211; thence southward of Charstone rock light. Having arrived opposite Mathern upper pill, it is usual to keep half a cable off shore, a distance which will lead in the best water into the Wye. It is necessary in going up the river towards Chepstow to avoid Tidenham stone, which has 6 feet over it when Fair-tide rock at Red cliff is covering; the stone lies about 70 yards northward of Ewen's rock, between it and Graving rock, and opposite an old oak tree on Thornwell's farm; it should be left on the starboard hand.

Berthing.—Near the railway bridge, vessels drawing 10 to 12 feet may lie afloat at all times, as before stated, while there are

several quays with 20 feet alongside them at high-water springs, and a good bottom of soft mud, under sheer legs capable of lifting 70 tons.

Tides.—It is high water, full and change, at Chepstow, at 7h. 30m. local, or 7h. 41m. Greenwich time ; mean springs rise 38 feet, and neaps $28\frac{1}{2}$ feet. The tide has, however, been known to rise as high as 56 feet.

Trade.—The river Wye is famed for its salmon fishery. There are iron-works for the manufacture of masts, boilers, and bridges, and good facilities for effecting repair to hull and machinery ; within a short distance of the town are several paper mills. There is, however, but little trade, and the exports are nil. 230 vessels entered the port in 1888, of the aggregate tonnage of 11,362 tons. Chepstow has ceased to be a Customs port.

The population of Chepstow in 1881 was 3,591.

SHARPNESS, the entrance from the Severn to the Gloucester and Berkeley canal, is upon the left bank of the river, by which it is 27 miles below the city, $16\frac{1}{2}$ miles above King road, and 10 miles above Aust head ; the width of the river is here half a mile, increasing below to about one mile, but at low water, with the exception of a narrow, winding, and shifting channel nearly dry in places, it is filled up with the Oldbury, Shepperdine, Lydney, and Sanagar sands.

Wet dock.—At little more than half a mile below Sharpness point are the Sharpness wet docks, opened in 1874. The tidal basin is 546 feet in length by 275 feet in width, enclosing an area of about 4 acres, with an entrance 60 feet wide, fronted by open timber guiding piers, and a depth over the sill of 29 feet at high-water springs, and 16 feet at neaps.

From this basin a lock, 320 feet in length by 60 feet in width, with a depth of 24 feet over the upper sill at high water springs, and 14 feet at neaps, leads to the wet dock, 2,200 feet in length and from 430 to 200 feet in breadth, and a depth of 23 to 24 feet ; at the eastern end of it a short branch forms a junction with the Gloucester canal about 400 yards within its entrance locks. The depth of water over the entrance sill here is rather more than on the upper entrance sill to the canal at Sharpness point (p. 215) ; also the velocity of the tide is not quite as great as at that entrance, and access is easier. The gates are open for about $1\frac{1}{2}$ hours before to half an hour after high water.

Within the wet dock, nearly parallel to the lock, is a graving dock 350 feet in length, with an entrance 50 feet in width, and a depth over the sill of 15 feet.

These docks have water communication with Gloucester, Birmingham, South Staffordshire, and the interior of the kingdom; they are also connected with the whole railway system of the kingdom by means of the Midland and Great Western railways. A railway bridge, 1,387 yards long, across the Severn at about half a mile above the docks, directly connects them with the South Wales and Forest of Dean coal-fields.

Tidal lights and signals.—The English ensign hoisted at the end of the north pier by day, and *two fixed white* lights at night, signify that the dock gates are open. Also a *fixed white* light is exhibited from the pier when the state of the tide renders it necessary to guard against vessels striking the pier.

A *fixed red* light is exhibited on the high land north-eastward of the pier when specially required.

Directions.—See p. 210.

Supplies for daily use can be had at Sharpness, and good water from the canal, with which it and the docks are supplied. Coal in any quantity, with short notice.

There is a cottage hospital at Berkeley, to which the dock company subscribes for the use of sailors.

Trade.—The number of vessels that entered the docks in 1888 amounted to 645, of the average tonnage of 387 tons. The chief imports are grain and timber, and the exports salt and pitch.

LYDNEY, a town and seaport, situated upon the right bank of the Severn, is by land 20 miles south-west of Gloucester, and $1\frac{1}{2}$ miles from the river. The port is connected with the Severn and Wye and Severn Bridge railway, which runs through the Forest of Dean, serving various collieries, iron-mines, quarries, &c., and joins the Ross and Monmouth railway near the river Wye at Lydbrook. This railway also crosses the Severn, by the Severn bridge, to Sharpness, where it joins the Sharpness dock sidings, and the Midland railway.

The sands off the port dry at 4 hours' ebb, and the main channel of the river is on the opposite side. The rapidity of the tidal stream is very great at springs, forming a strong eddy near the port.

The port consists of a tidal basin, approached between two piers, the northern of which is 200 feet in length; and a lower and upper dock connected together by a canal three quarters of a mile in length.

The depths in the Severn are the same as to Sharpness, p. 209. Directions, p. 210.

Wet docks.—The tidal basin is 270 feet in length by 75 feet in breadth, having a depth when level with the dock or canal of 23 feet,

to which it is connected by a lock 25 feet in width, with a depth of 14 feet over the upper sill ; the length of the lock is 100 feet, but this is immaterial as the tidal basin is filled to the level of the lock ; the sea gates are 33 feet in width, with a depth of 24 feet over the sill at high water ordinary springs.

The lower dock is 780 feet in length, 105 feet in width, and 14 feet in depth. The upper dock is 908 feet in length, 88 feet in width, and 12 feet in depth. There is one coal tip in the tidal basin, three in the lower dock, and five in the upper dock.

Signals.—A black ball is hoisted upon the pier head, when vessels about to enter are to remain outside, until vessels leaving the dock have passed out ; a light is shown at night when the gates are open.

A warping buoy is moored above the pier to assist sailing craft to the anchorage out of the stream.

Trade.—The trade is chiefly carried on in trows or river vessels, but vessels up to 500 tons carry coal to Cornish and Irish ports ; vessels however, above 300 tons cannot conveniently be accommodated, but they can be loaded at Sharpness, where the cost is the same. The exports are the produce of the Forest of Dean, consisting of coal, iron, tin-plate, timber, and bark ; the total export in 1888 amounting to 250,000 tons.

Lydney is a creek of Gloucester ; population in 1881 was 2,545.

GLOUCESTER stands on a gentle eminence on the left bank of the Severn, where it is divided into two channels by the isle of Alney, and crossed by road and railway bridges, the width of the river being about 100 feet ; it has been an inland port for centuries, but only since the opening of the Gloucester and Berkeley canal, in 1827, has it become of commercial importance, and since which time, the river quays have become practically neglected.

Canal and Docks.—The canal, which in some places runs alongside the banks of the river, and upon a dead level, is $16\frac{1}{2}$ miles in length from the city to Sharpness point, of an average width of 86 feet, and with a navigable depth of 15 feet, admitting of the passage of vessels of about 700 tons.

The canal is entered through a basin of $2\frac{1}{2}$ acres, the sea gates being $37\frac{1}{2}$ feet in width ; between the basin and the canal there are two locks abreast ; the largest, adapted for shipping, is 159 feet long and 35 feet in breadth, with a depth of 18 feet over the upper sill into the canal.

The depth over the sill of the sea gates is very irregular and uncertain ; but an average spring affords $27\frac{1}{4}$ feet, and a neap $15\frac{1}{2}$ feet.

For depths in river, see p. 209.

Signal.—From the pier flagstaff, a red flag is shown by day, and a light by night when the gates are open.

The wet docks at Gloucester occupy about 13 acres, affording upwards of 3,000 yards of quayage, the whole of which is connected with the narrow, and a portion with the broad, gauge lines of railway, on to which vessels can either discharge direct or into the warehouses behind. The docks are connected with the river by a small lock, for the passage of river craft only. There are three graving docks; the largest is 165 feet in length by $35\frac{1}{2}$ feet in width at the entrance, with a depth of 12 feet over the sill.

The railway lines in immediate connection with the city are the Gloucester and Cheltenham, and the Great Western round from Bristol to South Wales.

Trade.—The manufactures of Gloucester are chiefly iron-founding, rope, sail-making, boat and some ship-building. The exports, a considerable quantity of salt, some coal and culm. The foreign trade is principally with America, Russia, the Black sea, and the Baltic.

About 4,300 coasters enter the port annually, of the aggregate tonnage of 250,000 tons, and about 400 foreign-going vessels, also amounting to about 250,000 tons.

Supplies and ship stores of all descriptions can be obtained, and there is a Sailors' home near the docks. The population of the borough in 1881 was 36,521.

Tides of the Severn.—It is high water, full and change, at Sharpness, at about 8h., or three-quarters of an hour after King road; equinoctial springs rise about 31 feet, or 13 feet less than at King road; ordinary springs rise, 27 feet, and neaps, 15 feet; much governed by the wind; the flood stream runs for about three hours. Off Aust head the flood runs with a velocity of 5 knots, and the ebb $5\frac{1}{2}$ knots; above Aust head it is of uncertain and unequal velocity.

At Gloucester, it is high water at full and change about 9h. 45m. or $1\frac{1}{2}$ h. later than at Sharpness; springs rise about 5 feet; the duration of the flood, which is only experienced for about four days before and after full and change, is about one hour, the stream continuing to set up the river 20 minutes after the water has commenced falling at Gloucester. Before the weirs were constructed, the tide occasionally reached Worcester; now and at springs only, to the weir at Tewkesbury, at times flowing over it.

The Hygre, or Bore, rushes up the river with considerable noise, and a front of 4 to 5 feet; it is experienced in the several

channels from about 2 miles above Sharpness, but not in a continuous wave from shore to shore, until past Longney, 9 miles below Gloucester, and where the river is but 90 yards in breadth. It is observed to be highest about the fifth flood after full and change, and occasioned by the contractions of the stream below.

CHAPTER VII.

ST. GEORGE'S CHANNEL AND IRISH SEA, EASTERN SHORE.

ST. BRIDE'S BAY TO NEW QUAY.*

VARIATION IN 1891.

South Bishop - 19° 40' W. | New Quay - - 19° 15' W.

The Smalls, and the islands and dangers lying between it and the entrance to Milford haven, are described in Chapter IV., p. 83.

ST. BRIDE'S BAY, the entrance to which is situated between the islands of Skomar and Ramsey, is $6\frac{1}{2}$ miles wide, and $7\frac{1}{2}$ miles deep. Wooltack point, mentioned on p. 88, westward of which is Jack sound, forms the south point of it. The bay is free from hidden dangers, except off that portion of its shores between Ramsey island and Solva. The general character of the bottom is fine sand and mud, excellent holding-ground; the depths are regular throughout, diminishing from 20 fathoms at its entrance to 10 fathoms at $1\frac{1}{2}$ miles off the low-water margin at its head, but it is too much exposed to the prevailing winds to be anything but a temporary anchorage. In strong winds between W.N.W. and S.W. a heavy sea tumbles home, which might render it impracticable for a sailing vessel to work out; and, therefore, great care should be taken to avoid being so caught. There are, however, two anchorages where small coasters find shelter, namely, Gouldtrop road and Solva creek.

Gouldtrop road lies eastward of Gouldtrop head, and about 2 miles within Stack rocks. Coasting craft occasionally anchor here in 3 or 4 fathoms, over sandy ground, about one-quarter of a mile within the head, riding quietly with the wind to the southward of W.S.W., but, if to the westward of that bearing the anchorage would be untenable; if caught here, coasters might beach in Little haven.

The tidal stream runs to the westward on the south side of the bay, through this roadstead, and by Stack rocks, for 9 hours, turning about two hours before high-water on the shore.

* See Admiralty chart :—Bristol channel to New quay, No. 1,410; scale $m=0.6$ inches.

Little Haven, in Gouldtrop road, is an inlet about one cable in length by about 70 yards wide, open to northerly winds; is used by small coasting craft occasionally. The low-water feature extends half a cable beyond its western point, on which is a coast-guard flagstaff.

The village at its head is a summer watering place.

A **lifeboat** is stationed here; it is also a coastguard station.

Solva creek, on the north side of St. Bride's bay, lies about 5 miles eastward of Ramsey sound; an islet nearly fills its entrance, which, westward of the islet, is about 50 yards wide, with a depth of about 2 fathoms at low-water, shoaling within; small vessels that can take the ground will find ample shelter in it. It dries out at low-water springs to about one cable within the entrance, but at high water vessels can go a considerable distance up the creek. No craft could enter or leave it during southerly gales.

Lifeboat.—A lifeboat is stationed at Solva.

Greenscar is an islet 108 feet in height, situated half a mile south-westward of Solva creek, having to the westward a rock named the Blackscar, with rocky patches extending half a mile to the westward of it. There is also a rock above water named the Mare, one cable eastward of Greenscar, with a depth of 3 fathoms between them; between these islets and rocks and the entrance to Solva, there is anchorage with offshore winds in from 4 to 8 fathoms.

Portholaise inlet, situated midway between Solva and Ramsey island, affords shelter to small coasting craft; it is about 50 yards wide, and dries out to the small landing pier situated about half a cable within the entrance points.

Portholaise rock dries 5 feet at low-water springs, and is situated half a mile S.S.W. $\frac{1}{2}$ W. from the west point of Porthclaise inlet, with the south point of Crow rock and the south point of Porthllisky Bishops rocks in line. The highest hill of Ramsey open of these Bishops leads south-westward of the rock.

St. David's is situated about one mile north-eastward of Porthclaise inlet; its cathedral lies in the valley, and is not visible from the bay, but the hotel on the hill southward of it is conspicuous.

The **coast-guard** station is southward of the hotel, within Penplide island; a rocket apparatus is kept there.

Porthllisky bay lies between Crow rock, 58 feet in height, and Penmaen Melyn the south-east point of entrance to Ramsey sound; it is about 4 cables in length, with an entrance westward of the

Bishops one cable in width, with depths of 8 fathoms, decreasing towards its head ; it is exposed to southerly winds, but affords secure anchorage for coasting craft waiting the tide to proceed northward.

Stodair rock, awash at low-water springs, lies $1\frac{1}{2}$ cables south-eastward of Crow rock.

Tidal streams.—The tidal streams are not strong when well within the points of St. Bride's bay ; the flood sets to the eastward on the south side, westward of Stack rocks, and out to the westward along the north side. The ebb runs in a contrary direction, so that there is generally a set out of the bay either on one side or the other, according as it is flood or ebb.

There is a strong eddy on the north side of St. Bride's bay, near Porth-lisky, caused by the rush of the ebb stream through Ramsey sound, which must be guarded against, if working to the southward, by keeping sufficiently to the westward to be within the influence of the true tide. On the flood a vessel must be well to the eastward, and pretty close to the entrance, before she will be within the limits of the true tide of Ramsey sound, as even with the entrance open, at only half a mile distant, the tide sets westward or out towards Ramsey island.

Half-way between Skomar and Ramsey, the flood stream begins nearly 4 hours after low-water on the shore, or one hour before low-water at entrance to Liverpool.

RAMSEY ISLAND* is $1\frac{1}{2}$ miles in length, in a true north and south direction, with an average breadth of half a mile. Only a few spots on the island are suitable for cultivation, and it is chiefly used for sheep grazing. There is a small farmhouse on its eastern side abreast the Bitches, in the bay northward of which is the only good landing-place ; the entire boundary of the island, with the exception of Aber-mawr bay, on the west side, consisting of high and precipitous rocky cliffs. On the western side the land rises suddenly to a considerable elevation, forming Ramsey hill, 444 feet above high-water, a conspicuous object from the sea, and a useful mark for the shoals in the vicinity of the Smalls ; Ramsey saddle, 326 feet in height, is situated near the north-west extreme of the island.

Islets and rocks.—Several islets and rocks are scattered around the southern portion of Ramsey ; the largest of which, Ynys Bery, extends about half a mile in a south-westerly direction from the south point ; and the rocks, which are all above water, lie so close to the island, and so far out of the track of vessels, that they require but little notice.

* See Admiralty chart of Ramsey sound, No. 1,482 ; scale, $m=3\cdot0$ inches.

RAMSEY SOUND is a straight navigable channel for small craft locally acquainted, of about 2 miles in length, and from one quarter to two-thirds of a mile in breadth, the narrowest part of the passage being abreast the Bitches. Its western side is formed by Ramsey island, and its eastern side by the coast of Pembrokeshire from Penmaen Melyn point to Pencarnen point, the whole extent of which is practically free from danger, excepting Shoe reef and Horse rock.

The shore is, however, mostly cliff, and landing can only be effected during the short period of slack water near the lifeboat station.

Depths.—It would be useless to describe the depths in Ramsey sound as, from the rapidity of the tides, it would be impracticable to get a couple of casts before a vessel is swept through; but there is plenty of water, though the depths are exceedingly irregular.

Carreg Eilun.—Two islets about one-quarter of a mile to the eastward of Ynys Bery (p. 220), may be said to form the west side of the entrance into Ramsey sound. The western rock, Carreg Eilun, is 83 feet high, the other, Pontyr Eilun, is only just above high-water springs.

Sylvia rock, with a depth of 3 fathoms, lies S. $\frac{1}{4}$ W. nearly half a mile from Carreg Eilun, and in the fairway into Ramsey sound.

St. David's head, in line with Penmaen Melyn point, bearing N.N.E. $\frac{1}{4}$ E., leads one cable eastward of Sylvia rock; and Daufraich, the rock north-eastward of South Bishop, open southward of Meini-duon, N.W. $\frac{1}{2}$ N., leads south-westward of it.

Shoe reef lies one cable S. by W. $\frac{3}{4}$ W. from Penmaen Melyn point, on the east side of the entrance; it dries 9 feet at low-water springs, with some small heads a few yards northward of it. St. David's head, kept in sight, leads westward of the Shoe.

Bitches.—The Bitches form a curious ledge of high rocks, extending at right angles from the middle of the east side of Ramsey island for about 2 cables into Ramsey sound; two rocks, dry about 4 feet at low-water springs, lie 50 yards eastward of the outer Bitch.

Horse is a dangerous rock lying near the middle of Ramsey sound; it dries 3 feet at low-water spring tides, and though its position is generally shown by overfalls, yet at neap tides and near slack water it is not always to be made out. From its centre, the south part of Carreg-trai (which is nearly always above water) is just open of the north-east point of Ramsey island; and the centre of Gafaeliog is in line with Pencarnen point.

Penmaen Melyn point in line with a conspicuous cliff or break in the ridge of Skomar island near its eastern end, bearing S. by W., leads westward of the Horse (*see* view on plan); but this mark is not always visible. Gwahan rock, 5 feet high, touching the north-east extreme of Ramsey island, leads well westward of the Horse, and eastward of the Bitches. St. David's head, shut in with Pencarnen point, leads eastward of the Horse.

Gwahan rock is 5 feet high, and situated 4 cables off the north-east point of Ramsey island; it may be approached within a reasonable distance, there being a safe channel between it and the island. The name implies that it splits the ebb into two streams.

Gafaeliog is a large rock, 10 feet high, at about one cable from Pencarnen point; a reef, dry at low water, lies between it and the point, and a patch of 2 fathoms at $1\frac{1}{2}$ cables south-west of it; Gafaeliog, therefore, should be given a berth of 2 cables or more.

Anchorage.—A few small coasters may find snug anchorage in Ramsey sound while waiting for tide, even in blowing weather, except with northerly winds, which usually bring in a heavy swell; but vessels of any length would run considerable risk here. The best berth is under Ramsey, about $1\frac{1}{2}$ cables northward of the Bitches, and at the same distance from the island. They will lie there in 5 fathoms, mud, well clear of the Sound stream; a precaution to which the pilot should particularly attend. In proceeding to the anchorage from the southward, care must be taken with a flood-tide not to round the Bitches too closely, as the eddy extends from them for some distance. On the ebb, a vessel may take up her berth with more facility, but a sailing vessel would not get in from the southward except with a very fresh breeze and towards slack water.

Whitesand bay, under St. David's head, affords temporary anchorage in 4 to 6 fathoms, sand, but it is exposed to westerly winds.

Tides.—It is high water in Ramsey sound, full and change, at 6h. 0m. local, and 6h. 21m. Greenwich; springs rise about 17 feet. The stream runs through the sound for at least three hours after the turn of high and low water by the shore, with about 20 minutes of slack water on each tide. The northern stream ends $2\frac{1}{2}$ hours before high water at the entrance to Liverpool.

Flood stream.—It has been already stated (p. 220) that, unless near the entrance to Ramsey sound, and well to the eastward, the flood stream scarcely draws into it, but sets across towards and southward of Ramsey island. Within half a mile, however, of

Penmaen Melyn point, a vessel will find herself within its influence, and will be swept through with great velocity. In the narrow part of the sound, between the Bitches and Horse rock, the rate of spring tides is 6 knots, increased by southerly winds, and decreasing to 3 knots abreast Gafaeliog, northward of the sound, from whence it sweeps gradually round St. David's head at the distance of half a mile from the shore.

The branch of the flood stream which sets along the outer and western side of Ramsey island bends round its north end, and then, meeting the stream from the Sound, produces a strong eddy, which sets back to the southward along the eastern side of the island, as far as the Bitches. Another eddy, or counter tide, will be found on the eastern side of the Sound, reaching to as far as the Horse and then forming itself into highly dangerous vortices. To an experienced pilot, however, these eddies are sometimes of great service in working up to an anchorage.

Ebb stream.—The ebb stream, after setting closely round St. David's head, strikes upon Gwahan rock, near which it divides; one stream passing outside Ramsey island, and the other through the sound.

The ebb also forms two eddies, one returning along the western side of the island from Ynys Bery to the north point, where it unites with the true tide; the other begins at the Horse, and running along the eastern side of the sound to as far as St. David's head, there also meets with the true ebb stream. These eddies are not felt until the first quarter of the tide, that is to say, not until it has acquired its strength.

Directions.—Notwithstanding Ramsey sound has plenty of water for vessels of any draught, it is not advisable, owing to its narrowness in some parts, and the violence and eccentricities of its tides in others, for vessels other than coasting craft with good local knowledge to attempt to proceed through it.

Slack water is obviously the best time for going through Ramsey sound, attending to the marks for clearing the dangers. The passage, however, may be taken with a favourable tide, but only with steam or a leading wind and great attention to the helm, as the eddies sometimes cause a vessel to take an alarming sheer; small sailing vessels very commonly have a sweep over the stern for the purpose of assisting the helm, the great object being to keep in the fair stream of tide. If intending to pass southward through the Sound on the ebb, it will be prudent to keep near St. David's head, for,

if too far to the westward, the stream will inevitably carry a vessel outside of Ramsey island; and if bound to the northward on the flood, a similar precaution is necessary when crossing St. Bride's bay.

Lifeboat.—There is a lifeboat stationed near St. Justinian in Ramsey sound, and a rocket apparatus at the coastguard station southward of St. David's.

BISHOPS AND CLERKS.—The well-known group of islets and rocks, the Bishops and Clerks, situated to the westward of Ramsey island, are dispersed over a considerable space, their extremities being more than 3 miles apart. Fortunately for the navigator, the four principal islets, or Bishops, lie on the west or outside of the sunken dangers, and being of considerable elevation, and for the most part bold-to, the seaman may pass them at a prudent distance. The Clerks is the name applied to the dangerous rocks, which cover at high water.

SOUTH BISHOP, the south-westernmost of the group, is about 250 yards in length, 100 feet in height, and situated about 2 miles westward of Ramsey island, with the Smalls lighthouse bearing W. by S. $\frac{1}{4}$ S., distant $12\frac{1}{2}$ miles. Sunken rocks extend about half a cable north-eastward of the South Bishop, and there is a tide race off its west extreme.

The South Bishop is about two-thirds of a mile from Daufraich, and, as the channel between them is free from eddies, has a true tide and is quite safe, it may be used at any time, with a favourable stream.

LIGHT.—From a circular white lighthouse, 36 feet in height, erected on the summit of the South Bishop, is exhibited, at an elevation of 144 feet above high water, a *revolving white light every twenty seconds*, visible in clear weather from a distance of 18 miles.

Fog signal.—During thick or foggy weather, at intervals of *fifteen minutes*, *two explosive reports* produced by means of a powerful rocket, are given, each sounding like that of a gun, the interval between the two reports being *five seconds*.

Temporary anchorage.—A bank of sand, gravel, and broken shells stretches for 3 miles southward of the South Bishop, with depths of 13 to 20 fathoms, and is suitable for a vessel to anchor upon to await a favourable tide in fine weather. A good mark for this purpose is the North Bishop in line with the west point of Carreg Rhoson, and Crow rock touching Meini-duon, in from 13 to 17 fathoms.

Daufraich is a flat islet about 300 yards in length, and, unlike the South Bishop, is unsafe of approach on its north and eastern sides, on account of some low and dangerous rocks which lie in those directions, described with the Clerks. By giving the islet a berth of one-quarter of a mile, vessels may pass between it and Carreg Rhoson.

Carreg Rhoson, about 250 yards in length, is prolonged east and west by ranges of high rocks, so that its collective length is about two-thirds of a mile. Making due allowance for the eddies, which are found more or less among all these islets, it may be safely approached, as it is free from sunken rocks.

There is a fair channel between Carreg Rhoson and the North Bishop, but it is better to pass westward of all the islets.

North Bishop, the northern of the group, lies $2\frac{1}{2}$ miles westward of St. David's head, and in coming out of Cardigan bay, it is the first of the group that opens clear of the head. The islet is 120 feet in height, with a chain of high rocks extending east and west from it, making its whole length rather more than half a mile.

Bell rock has a depth of 8 feet over it at low-water springs, and lies E. by S. $\frac{1}{2}$ S., distant $2\frac{1}{4}$ cables from the eastern rock of the North Bishop group, with the South Bishop light in line with the two western rocks of Carreg Rhoson, bearing S.W.

Overfalls.—There are heavy overfalls and whirls of the tide over Bell rock, and also over the broken and foul ground which extends about one mile westward of the North Bishop group, and which should be given a good berth at all times.

THE CLERKS.—Besides the Bishops, there are five rocks of smaller dimensions, named their Clerks; these latter are dangerous to strangers attempting the passage between the Bishops and Ramsey island, as some of them cover at the last quarter-flood, and cause at springs the most alarming eddies and whirls of the stream; but it may be useful to remark that none of these rocks lie southward of Daufraich, nor northward of the North Bishop—nor, which is of greater importance, are any of them to the westward of the group.

Carreg Trai, the northernmost danger, is about one cable in extent and dries 13 feet at low water springs, in three heads; it is steep-to, and its position, even at high water, is generally indicated by the sea breaking. A patch of $4\frac{3}{4}$ fathoms lies about 2 cables E. $\frac{1}{2}$ N. of it.

Maen Rhoson is a rock, 30 feet high, and steep-to, situated 2 cables northward of Carreg Rhoson.

Moelyn, Cribog, and Maen Daufraich, three dangerous rocks, lie on the bank with less than 10 fathoms extending eastward or within Daufraich islet; the Maen being about one cable northward of Daufraich; Cribog $1\frac{1}{4}$ cables East, and Moelyn more than one-third of a mile in the same direction, with no safe passage between them. Moelyn dries about 14 feet at low-water springs, covering at the last quarter of the flood, but the other two only show at low-water springs.

Llech Uchaf and Llech Isaf, situated midway between Daufraich and Ramsey island, lie on the same ridge, about 4 cables apart, and 6 cables westward of Ramsey island; the first named rock is 5 feet above high-water springs, the other is covered 3 feet at that time, and dries 12 feet at low water.

The ground about the rocks is uneven and foul, with heavy overfalls; and half a mile S.S.W. from Isaf is a rocky patch with depths of 7 to 10 fathoms, upon which there is also a heavy overfall.

Bankyn-fald rock, situated one cable south-westward of Ramsey hill cliff, dries 12 feet at low water, and with a similar rock within it to the south-eastward, are the only dangers close off Ramsey.

Channel.—Uchaf rock, and Isaf rock, *when seen*, distinctly mark the channel between them and Ramsey island, which although narrow, is a good one, and to be preferred to any other in the vicinity, from the direct course of the stream through it, and the bold character of the greater part of Ramsey island, which is the safe-side to keep on. This passage is a much safer one than Ramsey sound, as the streams are not so rapid and eccentric as they are there.

Tidal streams near the Bishops.—The flood stream, at about 2 miles westward of the Bishops, sets N. by E. $\frac{1}{2}$ E., about 5 knots at springs, and 2 knots at neaps. Northward of the North Bishops, the flood draws gradually round to the eastward, setting parallel to the Bais bank, but inside that bank it sets E.N.E. parallel to the coast.

The flood, near the south end of Ramsey island, follows the general direction of its coast, setting fair between it and the Llechs, and then trends gradually to the eastward round St. David's head, ceasing about 2 hours before high water at entrance to Liverpool; westward of the Bishops, the flood runs half an hour longer.

Within Carreg-trai the ebb, or southern stream, sets inside or eastward of the Bishops, but varies its directions through the different channels, its general course being about W.S.W. Near

Ramsey island its course is more southerly, following in an opposite course to the flood the direction of the island, and setting pretty fairly through the channel between it and the Llechs.

Between Carreg-trai and the north Bishop the ebb stream pursues its W.S.W. course, passing northward of Carreg Rhoson; but between Bais bank and north Bishop it sets nearly W. by S., afterwards resuming its more southerly direction, but with decreasing strength; near the north Bishop it runs nearly 6 knots at springs.

GENERAL DIRECTIONS.—Sailing coasting craft, bound to or from the Bristol channel, are often compelled to make their way through the dangerous collection of rocks, Bishops and Clerks, a description of which, with their channels, has been already given; but it is necessary to repeat that the passage close westward of Ramsey island is preferable to Ramsey sound, and also that it is advisable to keep within Carreg-trai. The channel between Carreg Rhoson and the North Bishop is also a safe one in fine weather and at neap tides, but at spring tides, or in stormy weather, a dangerous overfall is formed over the rocky banks extending westward from the north Bishop.

It cannot, however, be too strongly impressed on all those who frequent this neighbourhood, that none of the passages should be attempted at night, or in thick weather; also, that all vessels, large or small, which may be outside Bais bank and bound to the southward, should keep outside of the Bishops and their Clerks, as they will then have truer tides, smoother water, and freedom from danger. For this purpose the South Bishop light at night should not be brought to the westward of S. by W., as that bearing will give the south-west end of Bais bank a berth of about one mile, and clear of all dangers.

BAIS BANK is a narrow ridge of fine sand and broken shells; it begins near the North Bishop, a depth of 10 fathoms upon its south-western extremity, bearing from that islet N. by E., distant $1\frac{1}{4}$ miles, from whence it trends within the depth of 10 fathoms, N.E. by E. $\frac{1}{2}$ E., $4\frac{3}{4}$ miles, its breadth in places being less than one-third of a mile.* The least depth, 4 fathoms, is near the centre, with St. Davids head bearing S. by E. $\frac{1}{4}$ E., and South Bishop S.W. $\frac{3}{4}$ S., from whence it gradually deepens to its extremes. Northward and southward of the bank the water deepens rapidly to 25 and 30 fathoms.

* See Admiralty chart:—Bristol channel to New quay, No. 1,410; scale $m = 0\cdot6$ inches.

The bank may generally be discerned by tide rips. During gales the sea breaks heavily over it.

Clearing marks.—Directions.—Carreg Eilun, seen through the centre of Ramsey sound, bearing S.S.W. $\frac{1}{4}$ W., leads eastward of Bais bank (view A on chart), and into Ramsey sound; or South Bishop in line with Carreg Rhoson, bearing S.W. $\frac{1}{4}$ W. (view B.), also leads eastward of it, and between Bell rock and Carreg Trai.

Coming from the northward, inside Bais bank, the latter mark may be run until abreast North Bishop, when steer more to the westward, so as to pass northward of Maen Rhoson.

Ramsey hill, in line with North Bishop, bearing S. by E., leads southward of Bais bank.

At night, as before stated, South Bishop light, kept bearing southward of S. by W., leads westward of Bais bank.

The lead is the best guide in thick weather, and anything less than 20 fathoms must be the warning to tack.

COAST.—**St. David's head**, situated in the northern approach to Ramsey sound, though not more than 100 feet high at its western extreme, may be easily recognized by its proximity to the remarkable hill of Llaeithty, with which it is connected by a low bed of slate, the hill and the headland being both composed of trap rock.

Llaeithty peak, 592 feet in height, is a conspicuous cone, with steep sides, and a useful mark for clearing the dangers eastward of the Smalls.

Penberry, 573 feet in height, is another remarkable hill, only a few feet lower than Llaeithty, and which it somewhat resembles; its summit is rugged when seen from a westerly direction. The two hills are portions of the same chain, and, as they are only $1\frac{3}{4}$ miles apart, care should be observed not to mistake them when Llaeithty is used as a mark for avoiding the dangers near the Smalls, as before mentioned, p. 86.

From St. David's head the coast trends eastward for about $9\frac{1}{2}$ miles, when it turns suddenly to the northward, forming the conspicuous promontory of Pen Caer, the south-western and north-eastern extremities of which are Penbrush point and Strumble head. Between St. David's head and Penberry hill, a distance of 3 miles, the coast is perpendicular cliff, and steep-to, with no possible landing; but in the slate district, from thence to Strumble head, it consists of moderately high cliffs, with occasional breaks; many hamlets and farms show on the higher background.

Isolated dangerous rocks extend about half a mile off the coast between Penberry hill and Pen Clegyr.

ABEREIDDY BAY, situated $4\frac{1}{2}$ miles eastward of St. David's head, is open to westerly winds, but affords anchorage for coasters in 3 to 5 fathoms; small craft occasionally load slate here. Several dangerous rocks lie in the approach, the three outer are named the Isaf, Ganol and Uchaf, and collectively as the Llechau Cochion, all of which dry near low-water. Strangers should keep seaward of them.

Rocks in the approach.—**Uchaf rock** dries 5 feet at low-water springs, and is situated with Carreg-guilan point, distant half a mile, in line with the north part of the outer rock lying off that point; and the ruined mill in line with Garnfach hummock, situated half a mile eastward of Summer house point.

A sunken rock lies midway between Uchaf and Carreg-guilan point.

Ganol rock, three-quarters of a mile W.S.W. from the Uchaf, also dries 5 feet; Garnfach hummock, touching the north part of Summer house point, leads over it.

Isaf rock lies N.N.W., about half a mile from the Ganol, and dries 5 feet.

Monkey rock and Maen-traeth are two rocks near the shore, and are only dangerous to coasters bound to Abereiddy bay from the westward. The Monkey is situated southward of Isaf rock, about one cable distant from a high rock which is connected with the shore; it never dries. The Maen-traeth lies about a fifth of a mile W.N.W. from the Summer house, and dries only at low-water springs.

Maen Griffith, dry at low-water spring tides, lies in the north-east approach to Abereiddy, at one-third of a mile westward of Penclegyr, with Garnfach in line with the inner Carreg-guilan rock. After half-flood, there is water enough over it for the ordinary class of coasters.

Directions.—Clearing marks.—Vessels will pass seaward of all the dangers off Abereiddy bay and adjacent coast, and of Bola Bleiddyn to the eastward, by keeping the South Bishop open off St. David's head (*see* view C, on chart). Penberry hill kept bearing southward of S. by W. $\frac{1}{2}$ W. leads westward of them, and the ruined mill on the high ground, open eastward of Garnfach, leads eastward.

Coasters from the westward bound into Abereiddy bay must keep Garnfach, a rocky hummock, situated just eastward of Summer house

point, just touching, or perhaps a little open northward of the Summer house, which will lead outside of Monkey rock on the one hand, and well inside Isaf and Ganol on the other.

COAST.—**Abercastel**, is a fishing village situated about 3 miles eastward of Penclegyr point; the small bight affords no shelter, except to fishing craft that can beach.

Bola Bleiddyn, is a rocky patch with 13 feet at low-water springs, situated northward of Abercastel, with Daullyn island bearing S. by W. $\frac{1}{4}$ W., distant half a mile, and Carnfawr, 700 feet in height, in line with Carreg Bwch-du.

Carnfawr open northward of Carreg Bwch-du leads northward of Bola Bleiddyn, and the same hill in line with Pen Bwch-du leads inshore of it.

Tri-maen rocks.—Between Abercastel and Strumble head there are no dangers, except the Tri-maen, a few half-tide rocks lying in the bight between Pen Bwch-du and Penbrush.

Depths.—Between St. David's head and Pen Clegyr a depth of 20 fathoms will be found about one mile from the shore, gradually increasing to 30 fathoms at the same distance off Strumble head; and a depth of 20 fathoms will be found close to the headlands. The line of 30 fathoms is from 4 to $5\frac{1}{2}$ miles from the coast, and leads nearly in the stream of Bais bank. For Tidal streams, *see* page 235.

STRUMBLE HEAD stands prominently forward, and is one of the most conspicuous headlands in South Wales. It is a barren and rugged mass of trap rock, forming the north-eastern point of Pen Caer, which is the general name of the promontory. The hill of Carnfawr, with a rugged rocky summit, rises to the height of 700 feet: it has steep and remarkable sea faces, and is a valuable object for assisting the seamen to identify this portion of the coast.

Ynys Onen and Ynys Michael islets, or bare rocks, lie close to the western spur of Strumble head, and at low-water the inner and higher one is joined to it. They may be safely approached to within one-quarter of a mile, as there is a depth of 20 fathoms at that distance.

Strumble rocks are two small rocks close under Strumble head, which only appear at low-water springs, but, though they are close in, they are dangers to the small coasters that creep round this headland, to take advantage of the tide. One of them is East, one cable, and the other W.N.W., the same distance from the north-east pitch of the head, but only half a cable from the shore. Other parts of the head are bold-to.

Aberfelyn and Pen Anglas.—From Strumble head, the coast has a general direction east-south-east for $2\frac{1}{4}$ miles to the low sharp rocky point, Pen Anglas, which forms the north-western boundary of Fishguard bay; the whole of it is low, rugged, rocky, and bold-to. In the little creek Aberfelyn, $1\frac{1}{4}$ miles westward of Pen Anglas point, the French effected a landing in 1797, and the farmhouse, Trehowell, was their head-quarters on the occasion.

Strumble bank, formed of gravel and broken shells, with depths of 9 to 10 fathoms, is about half a mile in extent, and situated about one mile off the coast between Strumble head and Pen Anglas; but within it there is a deep gut with about 20 fathoms water. During spring tides, accompanied with bad weather, a heavy sea and overfall is formed here, which it is well to avoid.

A good mark for keeping outside of the bank is Brenin-fawr well open to the north-eastward of Dinas head (view D. on chart). This precaution, however, is only necessary when it is blowing hard, for, in general, the shore must be kept aboard by coasters working to the westward from Fishguard bay, in order to derive the benefit of the eddy-tide, mentioned (page 232).

For Tidal streams, *see* page 235.

FISHGUARD BAY* is included between Pen Anglas and Dinas head, a distance of 3 miles. The depth of the bay is $1\frac{1}{2}$ miles, and its shores consist generally of rocky cliffs of moderate height, backed by rugged summits.

The most remarkable of its hills are Llanllawer and Dinas head; the former, a conspicuous mountain with a nipple rock on its summit, is 1,107 feet high, and one mile inland, and is the beginning of a rocky ridge which runs nearly parallel to the coast for 3 miles, and terminates in another remarkable rugged top named Carnengyle, 1,152 feet above the sea. This ridge is separated from Precelly mountain range by a deep ravine, through which the river Gwaen discharges into Fishguard bay.

The shores of Fishguard bay are principally composed of slate, several quarries of which are worked.

Cow and Calf form a ledge of rocks extending about one cable from Pen Cow, the point next within Pen Anglas; the summit of the Cow, the inner rock, is 17 feet above high water springs, at which time the Calf is just under water; some stones dry out a few yards beyond, with deep water close to. Pen Anglas should not be brought northward of N.N.W. until Goodie pier opens out.

* *See* plan of Fishguard bay (scale $m=3$ inches), on Admiralty chart, Bristol channel to New Quay, No. 1,410.

Goodic sands, upwards of half a mile in length, front the shore to the distance of 2 cables at low water, whence the water gradually deepens to 3 fathoms at half a mile distant.

Pier.—On the north shore of the bay is a small fishery pier, just dry at low water springs.

There is a similar but smaller sand, the Pwll-Gwaelod, which terminates a strip of swamp that lies within Dinas head. This beach has better shelter than that of Goodic during easterly winds, and small vessels frequently lie upon it in fine weather.

Coastguard and lifeboats.—There is a coastguard station at Goodic. Two lifeboats and apparatus for communicating with stranded vessels are kept in constant readiness, one boat being stationed at Goodic, and the other a short distance within Pen Cow.

Fishguard road is of some importance to the coasting trade, affording, as it does, good shelter from all winds except those between North and East, which winds send in a considerable sea at times. It is frequented by small vessels requiring shelter, or waiting for the turn of tide. With the exception of St. Tudwall's road, Fishguard is the only tolerable anchorage with westerly winds, between St. David's head and Bardsey island.

The best anchorage is under the north-west shore of the bay, in Goodic road, in a depth of 4 to 5 fathoms at low water springs, over a bottom of mud and sand, with Pen Anglas seen between the Cow and Pen Cow, and Goodic pier about West. Small craft can go nearer to the lifeboat under Pen Cow.

Tides.—It is high-water, full and change, at Fishguard, at 6h. 56m. local, 7h. 16m. Greenwich; ordinary springs rise $12\frac{1}{4}$ feet neaps $9\frac{1}{4}$ feet, and neaps range 6 feet.

A weak stream sets into Fishguard bay from the eastward on the south side, and out round past Pen Anglas, from about high-water to the following half-flood; during the remaining three hours there is no stream.

Directions.—No directions are necessary for approaching Fishguard bay, beyond observing the clearing mark for Cow and Calf (p. 231), giving them a berth of $1\frac{1}{2}$ cables or more. In thick weather, the lead will give ample warning when approaching the coast.

When at anchor in the road, in a sailing vessel, care must be taken not to be caught by the wind shifting to the eastward of north, but to leave as quickly as practicable on the first appearance of a shift in that direction. In such a case the young ebb will greatly assist a vessel in getting round Strumble head, which, with the wind at North,

could not be weathered without an offing of 2 or 3 miles. As the flood tide, however, would still be running at that distance from the land, it is better to make short tacks close in so as to have the advantage of the westerly going eddy as before described.

See also remarks on the harbour.

The Harbour.—In a little bay near the the south end of Goodic sands, the river Gwaen discharges itself, and the outlet constitutes the harbour of Fishguard. The town stands on the summit the left bank, while Abergwaen or Fishguard Bottom, as it is at times termed, skirts the foot of the right bank by the side of the harbour.

The harbour is available at high-water springs for a few vessels of less than 10 feet draught, and those of 6 feet at neaps. The greatest in-run is in northerly and north-easterly gales, but this is partly checked by a short pier, just dry at low-water springs built about 300 feet outside the old quays. The harbour is dry long before low-water. The bottom of the harbour is mud and clay, with a coating of gravel.

In entering, keep midway between Castle and Saddle points, and avoid the numerous limestone heaps which are scattered about upon the west side.

Coasters riding in the road are sometimes caught by the wind shifting to the eastward of north when if they cannot get to sea, they obtain a pilot by signal from Goodic pier, and run for the harbour at tide time; in case of extremity, the best plan is to beach under Goodic village.

In north-easterly gales, small craft have been frequently wrecked when running for the harbour, on account of the heavy sea sent home by those winds.

Fishguard has no export trade, but coal, culm, and limestone are imported from the Bristol channel ports. The market affords abundant supplies. Fishguard is a creek of Cardigan. About 300 coasting craft, each of about 30 tons burthen, enter the harbour annually.

Population in 1881, numbered 2,009.

DINAS HEAD is a remarkable headland, 452 feet in height, appearing from most directions wedge-shaped, and dividing Fishguard and Newport bays from each other. The hamlet and church of Dinas are just above high-water mark in Newport bay, at the eastern end of the low swamp which almost insulates the head.

Coastguard.—There is a detachment of coastguard here.

Boat harbour.—Under and eastward of Dinas head is a little

boat-harbour, conveniently situated for the few boats engaged during the herring season ; it is partly protected by some low-water rocks lying a short distance outside low-water mark.

The coast, from Dinas head to the entrance of the river Nevern, consists of slate rock in rapid decay, with numerous small quarries in constant work. There are no outlying dangers, so that attention to the lead is all that is necessary.

NEWPORT BAY is contained between Dinas head and Pen-y-Bal. The latter is also high land and steep-to, with the exception of Carreg Drowy, a rock above high-water, connected to Pen-y-Bal by a ledge which dries.

The bay is about 2 miles across, by one mile deep, and is clean throughout, with depths decreasing regularly from 9 fathoms, to the shore. The ebb leaves uncovered a large tract of fine smooth hard sand at the entrance of the river Nevern, and which is safe for beaching.

In fine weather, and with southerly or easterly winds, vessels may bring up in Newport bay to await the tide, but no dependence should be placed on it affording shelter in bad weather. Anchorage may be taken up in any part of the bay, over a bottom of blue clay and sand.

River Nevern has its outlet at the head of Newport bay, between a rocky shore to the southward, and Newport sands to the northward, and though at low water it dwindles to a mere rill, it forms the harbour of Newport ; the channel is tortuous.

No stranger should attempt to enter the river without a pilot, who may be readily obtained. In the channel of the river are some awkward stones, which are dry at low-water, and it is, therefore, preferable to enter at high-water by crossing directly over the sands, and thus avoid the outer part of the channel.

Vessels drawing 12 to 13 feet may enter at high water ordinary springs, and those of 6 to 7 feet, at neaps.

During on-shore winds a considerable sea sets into the bay, and at times breaks furiously upon the sands, rendering access impracticable.

Being forced to run for the river in a case of extremity, beach on the western side of the sands, from whence vessels are more easily got into safety.

Tides.—It is high-water, full and change, at Newport, at 7h. 0m. local, 7h. 20m. Greenwich ; springs rise 12 feet, neaps 9 feet.

Newport is a regularly built town, on the southern side of the Nevern, and at the base of the bold rugged mountain Carnengyle ;

here are the ruins of a fine old baronial castle built in 1215. The town affords moderate supplies, and good water may be obtained from the stream Cwm-dwi, on the south side of the entrance to the river, and from two other streams between the latter and Dinas head.

Newport imports coal, culm, and limestone ; it is a creek of Cardigan. Population in 1881 was 1,514. About 70 coasting craft enter the port annually, each about 30 tons burthen.

Coastguard.—Lifeboat.—There is a coastguard station on the south side of the river ; and lifeboat and a rocket apparatus are kept there.

COAST.—From Pen-y-Bal to Kemmaes head the coast consists of slate, and is steep and high, and safe to approach in any part to the distance of half-a-mile. At $1\frac{1}{2}$ miles to the eastward of Pen-y-Bal, and close within the cliffs, is the round-topped hill Foelgoch, 623 feet high.

KEMMAES HEAD, a fine bold cape, with the land rising very steeply from the cliffs to the height of 580 feet, forms the western boundary of Cardigan bay.

Foul ground, with depths of $6\frac{1}{2}$ to 7 fathoms, extend nearly one mile northward of the head.

Directions.—To maintain a proper offing at night between Dinas and Kemmaes heads, strangers are recommended, as a general rule, not to go within a depth of 20 fathoms, so as to ensure a distance from the land of about 4 miles.

TIDAL STREAMS.—St. David's to Strumble head.—The tidal streams between St. David's head and Strumble head are regular in their course at some distance from the shore ; the set of the flood-stream being about E.N.E., and that of the ebb W.S.W., with a mean rate of rather more than 2 knots.

Near Strumble head.—Five miles northward of Strumble head the stream of flood runs E. by N., and closer in, to the southward of East, to Fishguard bay. The ebb stream at one mile off sets nearly parallel to the shore from Fishguard westward to Strumble head, whence it resumes its proper channel course, W.S.W., as it does also 5 miles to the northward of Pen Anglas. The spring tides run about 3 knots, and the neaps $1\frac{1}{2}$ knots. Between Strumble head and Pen Anglas, close in, or within half a mile of the shore, the stream sets westward along the coast at 7 hours full and change, or 3 hours before the ebb stream in the offing, and runs 9 hours.

Dinas head to Kemmaes head.—There is but little tidal stream in Newport bay, and that little is much influenced in its course by the sweep of the bay. Close outside, the flood sets about E. by S., and at the distance of 3 miles from Dinas head it gradually draws more to the northward, as the distance from the shore is increased. One mile from Pen-y-Bal, the ebb sets about West, partly trending round Dinas head into Fishguard bay, but close inshore, it sweeps round Carreg Drowy into Newport bay. About 4 miles off Pen-y-Bal, the general direction of the ebb is about W. by S., and for a mile or two off Kemmaes head it sets W.S.W., with an indraught into the several bays.

The velocity of the tides seldom exceeds $1\frac{1}{4}$ to 2 knots at springs, while the offing streams will be found to turn at about 3 hours after high and low water at Fishguard, or one hour before high and low water at entrance to Liverpool.

PORT CARDIGAN* is contained between Kemmaes head and Cardigan island, $1\frac{1}{2}$ miles apart, and is one mile in depth to the low-water margin at its head, where the river Teifi empties itself. The depths in the bay are regular, gradually decreasing from 7 fathoms between the points, to its head; the general character of the bottom is sand, except on the western side of the bay, where it is foul, but there are no outlying dangers.

Anchorage.—Unless going into the river when the tide permits, sailing craft should not anchor too far in, or in less than 6 fathoms, with the inn on the east side of bay shut in with Craig-y-Cwbert, as there might be some difficulty in getting out again. The bay, however, is not a fit stopping-place in bad weather, as winds between north-west and north-east throw a heavy sea into it.

Pilots.—Coastguard.—In communicating with the shore to obtain a pilot—and there are generally two or three on the look-out, but who have no boats outside the bar—one or other of two landing-places may be used according to the wind; that on the eastern side of the bay is behind the rocks, close under Craig-y-Cwbert, and the other is upon the western side, under Penrhyn, a castellated house with a flagstaff, now the coastguard station; here also is a small pier, but when there is any sea on no landing can be effected before half-flood, as the rocks outside the pier dry at low water. In extremity it might be advisable to beach near this spot.

The **Lifeboat** is stationed below the coastguard station.

* See plan of port Cardigan, scale $m = 3$ inches, on Admiralty chart, No. 1410.

Cardigan island, 178 feet in height, is 4 cables in length ; with the exception of the western end, off which low water rocks extend about half a cable, the island is steep-to. When the island is open off the land it serves as a good mark for the port, but at a distance off shore the best guide for being abreast port Cardigan is the mountain of Brenin Fawr, 1,285 feet in height, bearing South. Another mark for this part of the coast, when within 5 miles of it, is the sharp pyramidal hill, 257 feet high, named the Mount, $1\frac{1}{2}$ miles eastward of Cardigan island.

Cardigan sound, the passage which separates the island from the main, is a narrow channel, occasionally used by the coasters, notwithstanding some dangerous rocks on its south side, and there being only a depth of 12 feet in one part of it. The tides are rapid, and no stranger should attempt it.

River Teifi, the estuary of which forms the harbour of Cardigan, is the largest river which falls into Cardigan bay ; it rises in Llyn Teifi, a lake in Cardiganshire, a few miles from the source of the Towy, and, thence descending to the south-westward, reaches the vicinity of Tregaron. Below Lanio bridge it bounds the counties of Cardigan and Caermarthen, having on its right the town of Lampeter. At Llanfihangel-ar-Arth the river bends north-westward, and having received many tributaries, is, as it approaches Newcastle Emlyn, confined within steep banks fringed with wood ; a little beyond it is joined by the Kerry, and runs between Cardiganshire and Pembrokeshire. At Llechrhyd bridge it becomes tidal and navigable for boats, and, as an expanded stream, flows below the town of Cardigan, where it is crossed by a bridge ; 3 miles beyond which it enters the sea through a wide and sand-encumbered estuary. The whole length of the river is about 45 miles.

Beacon.—A barrel on a post marks the west side of the channel into the Teifi at about 2 cables N. by W. of Sandy point.

Tides.—It is high water, full and change, at Cardigan bar and bridge at about 7h. 1m. local, 7h. 20m. Greenwich ; springs rise 12 feet, neaps 9 feet, and neaps range 6 feet. At the bridge the stream turns and runs down about 20 minutes before the tide has ceased rising, and earlier than that if the freshes are strong.

Cardigan bar, directions.—At high-water springs there is about 14 feet on the bar, but not more than 9 feet at neaps. There may be a foot or two greater depth within the bar, but at low water there is not depth enough for a boat above Popit. two miles below Cardigan.

When nearly high water, steer in with the barrel beacon bearing S. by E.; pass close eastward of the beacon and about half a cable off Sandy point; as the channel within Sandy point is subject to change and the sand-banks are steep, a pilot should be taken if it is possible to get one. The bar is dangerous during fresh northerly winds.

Cardigan, situated about 3 miles above the entrance, on the north bank of the river, possesses some trade in slates and agricultural produce; the imports chiefly consist of coal and timber. About 900 coasting craft enter annually, averaging about 30 tons; vessels of about 200 tons enter occasionally.

The population in 1881 was 3,633.

St. Dogmael's, or Llanduloch, lies about three-quarters of a mile below Cardigan; it was once famous for its abbey.

COAST.—Traeth mount.—The remarkable peak $1\frac{1}{2}$ miles eastward of Cardigan island, and already alluded to, has within it a small snug nook, with a sandy beach, called Traeth mount, which offers a convenient smooth-water landing place with winds from southward or eastward.

Pen Cribach.—Three miles eastward of the mount is Pen Cribach, a bare table headland.

Aberporth.—There are three small places in the succeeding portion of coast eastward, where coal and limestone are occasionally discharged, but neither of them affords the least shelter. The first is Aberporth, a fishing village just south-eastward of Pen Cribach, and its little bay derives some protection from that head in westerly winds. Population 479. The second is Llangranwg, three-quarters of a mile south-westward of Pen Dinas Llochtyn ridge; and the third Cwm Tydi, about midway between Llochtyn and New Quay.

Coastguard.—There is a detachment of coastguard at Aberporth; also at Llangranwg.

Ynys Fach.—A long and remarkable ridge of rock terminating in Llochtyn point, or rather in a rock named Ynys Fach, projects from Pen Dinas Llochtyn, forming on its eastern side a little bay where coasting craft may lie for a tide in fine weather and off-shore winds, but a considerable sea quickly rolls in upon a change occurring.

Moel Badell, a remarkable hill just above the point, resembling an inverted pan, as its name implies, serves as a good land-mark from the eastward.

Between Ynys Fach and New Quay, the 10-fathoms line of soundings is about one mile off shore, and the bottom is foul in places for

anchoring ; patches of 9 to 10 fathoms also exist about 4 miles off shore.

NEW QUAY BAY may be considered safe for vessels in winds from West, through south, to N.E., but if to the northward of West such a heavy sea rolls in that it would be exceedingly dangerous, if not impracticable, for vessels to ride there. Those, therefore, bound to Cardigan bay should not reckon upon this place for refuge in bad weather.

New Quay head is the first conspicuous point eastward of Kemmaes head, and it may be known by a single windmill on the high ground about three-quarters of a mile within it. There are no off-lying dangers, and the shore, with its high rugged face, and two large rocks in front of it close to the head, may be freely approached. The easternmost of these rocks, named Carreg Waltog, is insulated, and the other and larger, Carreg Drenog, is joined to the land by a low isthmus, and is a remarkable object when seen from the eastward or westward.*

Carreg Ina.—There is much foul ground in New Quay bay, but nothing dangerous except Carreg Ina, the rocks which, forming the eastern horn of the bay, and covering at the first quarter-flood, stretch off for about 3 cables from the low point of Ina.

A can buoy marks the north-west side of Carreg Ina, in about $1\frac{1}{2}$ fathoms water.

Eastward of Ina point shallow water extends half a mile off shore. The cliff point eastward of Carreg Drenog in line with Carreg Waltog, or, at night, the pier light, showing *white*, leads northward of these dangers.

LIGHT.—From a light tower on the outer end of New Quay north pier is exhibited, from 15th September to 12th March, a small *fixed white* light ; inshore of a W. $\frac{1}{2}$ S. bearing the light shows *red* over Ina rocks.

Directions.—Anchorage.—In proceeding for the anchorage in New Quay bay, the head may be rounded at the distance of about 2 cables, and when Carreg Waltog is shutting in with the head, anchor in about 3 fathoms, sand.

Tides.—It is high water, full and change, at New Quay, at 7h. 30m. local, 7h. 48m. Greenwich ; springs rise about 13 feet.

* See Admiralty charts, England, west coast, New Quay to Holyhead, No. 1,411 ; scale, $m = 0.5$ inch ; also Gynfelin patches, Aberystwith, and New Quay, No. 1,486 ; scale, $m = 3.0$ inches.

The streams in New Quay bay are regular, and of little strength, not exceeding one mile an hour at springs.

NEW QUAY HARBOUR.—A pier projects from Pen-y-wig point, curving in an easterly direction for about 500 feet, with a small lighthouse at its outer end, as before described.

The space within the pier is sand and clay, dry at low water; vessels drawing 15 feet may enter at high water springs, and those of 9 feet at neaps. They lie with their sterns towards the pier, and with anchors ahead; but the pier affords but poor shelter during on-shore winds; the heaviest run into the harbour occurs during north and northwest gales.

Patent slip.—About 300 yards to the southward of Pen-y-wig, a stone pier extends from the shore in an east direction, within which is a patent slip capable of taking up vessels of 550 tons.

Coastguard. — Lifeboat. — A lifeboat is stationed a little within the inner pier, and life-saving apparatus is stored at the adjacent coast-guard house. The coast-guard watch house is near the inner end of the outer pier.

New Quay is frequented as a bathing place; its herring fishery is considerable, and it has imports of timber, coal, culm, and limestone.

The population of New Quay was, in 1881, 1,328.

CHAPTER VIII.

CARDIGAN BAY.

NEW QUAY TO BARDSEY ISLAND.

VARIATION IN 1891.

Cardigan bay - - - - - 19° 20' W.

CARDIGAN BAY.*—General remarks.—Cardigan bay, which may be considered to lie between St. David's head and Bardsey island, separated by a distance of about 60 miles, contains several dangerous shoals. The two most important are the Gynfelin, which extends some 6 miles from the shore, and the Sarn Badrig or Causeway, which extends 10 miles from the shore, both awash in places at low-water springs. These present a considerable danger to sailing vessels embayed in thick weather, more especially during south-west and westerly gales, and have caused many wrecks and loss of life.

As a warning against the danger of becoming embayed, a light vessel is placed in 35 fathoms, about midway between the Bishop and Bardsey lights, as a fairway guide between these positions. In, and westward of this fairway, the stream of tide runs nearly parallel to those lights, turning at the time of high and low water at the entrance to Liverpool, whilst nearer the shore, more especially between the light vessel and the Bishops, there is a considerable in-draught; the stream also turns from one to two hours earlier as the shore is approached; see p. 16 on tidal streams.

In thick weather, to navigate near the fairway track, vessels should keep in a depth of not less than 40 fathoms at low water.

CARDIGAN BAY LIGHT-VESSEL is moored in 35 fathoms, near a central position of Cardigan bay, in lat. 52° 24' 30" N., long. 5° 0' 30" W. The light, which is shown at 37 feet above the water, is *red, revolves every half minute*, and in clear weather may be seen from a distance of 10 miles. The vessel is painted red, with *Cardigan bay* on sides, and carries a ball at the mast-head by day. A watch buoy, black, lies half a mile eastward of the light-vessel.

From the light-vessel the Smalls lighthouse bears S.W. $\frac{1}{2}$ W., distant $47\frac{1}{2}$ miles, and Bardsey lighthouse, N.E. $\frac{1}{2}$ N., $21\frac{3}{4}$ miles.

* See Admiralty chart, New Quay to Holyhead, No. 1,411; scale, $m = 0.5$ inches. Cardigan bay re-surveyed by Staff-Commander W. E. Archdeacon, 1889-90.

Fog signal.—A gong is sounded during thick and foggy weather.

COAST.*—From New Quay head the coast, north-westward of New Quay bay, again trends easterly and northerly, and to as far as Aberaeron consists generally of perpendicular slate cliffs varying in height from 20 to 120 feet, from whence the back land suddenly rises to about 200 feet.

Carreg Gloyn.—Patches of foul ground, with depths of 5 to 6 feet, stretch out from one to 2 cables from the shore to as far as Pen-y-gloyn; Carreg Gloyn, with a depth of one foot only, lies 2 cables off shore, with Aberaeron pier bearing East distant half a mile; Aberaeron pier, bearing southward of E. by S., leads northward of the rock. The tower of Llanddewi church, kept open of an intervening brow, bearing E.S.E., also leads northward.

ABERAERON, situated 4 miles north-eastward of New Quay, is a small pier-harbour suited to the coasting trade. It is formed by the outlet of the Aeron, a small stream, the channel of which is fixed and defended by north and south piers, the south pier overlapping the northern one, the direction in between them being about S.E. by S. The entrance is encumbered by shingle, to turn which groynes are formed east and west of the piers, but there is no bar, properly speaking, for accumulations are quickly cleared away upon the occurrence of a fresh.

Vessels of 8 to 9 feet draught can enter at near high-water springs, and those of 5 to 6 feet at neaps.

Pilots are always in attendance, and their assistance is necessary to strangers on account of the limestone heaps scattered about the channel and along the inner face of the south pier in such a way as to be dangerous to craft entering. When the wind blows hard from the north west there is but little shelter at high water within the piers, the run being so great as to render the securing of vessels all but impracticable.

Small coasting craft are built and repaired at Aberaeron; wheat and potatoes are exported to a small extent, and coal, culm, limestone, and timber are imported. Aberaeron is a creek off Aberystwith.

Anchorage.—There is good anchorage with off-shore winds in 9 to 12 fathoms, sand, between one and two miles off Aberaeron, but within that distance the bottom consists of foul ground with large stones, in which anchors will not hold, even with moderate winds.

COAST.—From Aberaeron, the coast trends easterly, and continues of the same character to Aberarth, a small village with

* See Admiralty chart, New Quay to Holyhead, No. 1,411.

some limekilns on the shore abreast; it offers no shelter. Eastward, the shore is composed of cliffs, varying from 60 to 70 feet in height, the back land rising to 200 feet above them; the cliffs continue for $1\frac{1}{2}$ miles, whence the shore becomes flat and low to Pen Pygyn, the high ground receding half a mile from the coast.

Between Aberarth and Pen Pygyn are the two villages of Llansantffraid and Llanrhystyd, the former with a tower, and the latter with a spire church; both stand low, and are not conspicuous from the sea.

The more prominent objects upon the coast between New Quay and Pen Pygyn are the windmill, Pystyll and Pewshiw farm-houses on the high land near New Quay, and the small church of Henfynyw standing half a mile back from the coast, about one mile south-west from Aberaeron; also Llanddewi church on the high land, and Penrhiw farm house, just where the high land terminates, about half a mile eastward of Aberarth.

Cadwgan reef is a shallow projection from the point situated close northward of Llansantffraid church; its outer edge is half a mile from the shore, with a depth of 8 feet at low-water springs; as it causes a heavy sea in bad weather, coasters should give it a wide berth.

Between Cadwgan reef and Pen Pygyn, situated 2 miles north-eastward of it, numerous shoal patches of stones stretch off from a half to three-quarters of a mile, and from thence to within one mile of Aberystwith to about half a mile.

Clearing marks.—Moel Badell, in line with, or open of Drenog cliff, S.W. by W. $\frac{3}{4}$ W., leads north-westward of Cadwgan reef and the foul ground as far eastward as Pen Pygyn (View J, chart 1411), and Penglais farmhouse, open westward of Aberystwith castle, leads westward of the remainder and to Aberystwith.

The farmhouse stands on the high ground above Craig Lais, and is white, with a single chimney on its sea gable.

A vessel navigating between New Quay and Aberystwith should keep outside these clearing marks, in not less than 9 fathoms, as the tendency of both flood and ebb is to set a vessel towards the shore.

Pen-y-Dinas.*—From Pen Pygyn the coast is one continuous cliff to within one mile of Aberystwith, when it sinks to a low shingle beach, through which the rivers Rheidol and Ystwith find their outlet, and form the entrance of the harbour of Aberystwith. The hill, Pen-y-Dinas, 406 feet in height, standing detached from the

* See Admiralty chart of Gynfelin patches, Aberystwith, and New Quay bay, No. 1,486; scale, $m = 3.0$ inches.

adjacent high ground, with a monument on its summit, rises between the two streams, and from being so near the coast is a useful sea-mark.

Trawling ground.—Extending parallel to the shore at the distance of about 2 miles, from New Quay to within about 3 miles of Aberystwith, or over a length of about 10 miles, by $1\frac{1}{2}$ miles in width, are depths of 12 to 13 fathoms, muddy bottom, affording a good trawling ground. Within this trough the water shoals quickly to 9 and 8 fathoms, over stones, within which depths vessels should not venture.

RHEIDOL and YSTWITH RIVERS.—The Rheidol has its source upon the western side of the Plinlimmon mountains. After a progress of some miles between precipitous rocks, and passing under Devil's bridge, there is a waterfall at the junction of the waters with the Rhyddnant; from the confluence of the Rhyddnant, the Rheidol changes its course from southward to westward, flowing as a broader and more tranquil stream; and passing the church of Bangor, and by Llanbadarn on the south, it enters the sea at Aberystwith, after a course of 25 miles; on the south side of the town it is crossed by a bridge, and at about 250 yards above by the southern line of railway to Milford.

The Ystwith rises on the borders of Montgomeryshire, south-east of the Rheidol, and flowing southward of Eglwys-newydd and Pont Llanafan, curves round to the north-westward. It then flows northwards of Llan Ilar and under Pont Lianychaiarn, and, winding round the base of Pen-y-Dinas, effects a junction with the Rheidol, at the harbour of Aberystwith, after a course of about 20 miles. The Ystwith is also crossed near the pier by a road bridge, the railway passing along its eastern bank.

ABERYSTWITH,* advantageously situated at the lower end of the vale of Rheidol, near the confluence of the Rheidol and Ystwith, is a well-known resort of sea-bathers, and presents a pleasing appearance from the sea. Among its more prominent objects are the ruins of its castle, occupying the summit of a low promontory at the west end of the town, the monument on Pen-y-Dinas hill, already mentioned, south of the town, and the extensive college buildings just southward of the pier.

Pier.—An iron pile pier, about 200 yards in length, with a depth of 3 feet at its extreme at low water springs, is built out from the south end of the parade.

* See Admiralty plan :—Gynfelin patches, Aberystwith, and adjacent coast, No. 1,486.

Anchorage.—Vessels waiting for tide to enter the harbour will find good anchorage in about 5 fathoms, sand and clay, at about one-third of a mile seaward of the light.

The best landing-place at half-tide or low-water, is alongside the pier fronting the parade at the north-east end of the town.

Ledges.—A rocky ledge, named the Castle rocks, extends $1\frac{1}{2}$ cables south-westward of Castle point, northward of the harbour; a portion of the same ledge, named Pen Cwningen, extends one cable west, and another portion $1\frac{1}{2}$ cables northward of the point. Pen-y-Dinas monument, bearing S. by E. $\frac{3}{4}$ E., leads southward of Castle rocks in about 9 feet water; the monument, in line with the lighthouse, is a better mark. All the farmhouses on Clarach hill kept open westward of Carreg Fulfran, a conspicuous sugar-loaf rock 20 feet high, leads westward of all the ledges.

Harbour.—The outlet of the united rivers, which forms the entrance to Aberystwith harbour, is defended south-westerly by a pier 230 yards in length, extending in a north-north-west direction. Breakwater works are in progress, from near the ruins of the castle, in a south-west direction towards the centre of the south pier, to within about 100 yards of it.

The entrance has a depth of about 17 feet at high-water springs and 13 feet at high-water neaps; there are the same depths over a portion of the harbour, the bottom of which is gravel, but it is mostly dry at low-water springs. Alongside the quays there are depths of 7 to 10 feet at high water springs.

Vessels drawing 14 feet can enter it, during fine weather, at high-water springs, and those of 10 feet on neaps; but it must be remembered that the depth is rather uncertain, owing to the westerly exposure of the harbour and the shifting character of its bar, which is composed of shingle. The most dangerous winds are those from between S.W., through west, to North.

LIGHTS.—A *fixed* light is exhibited from the south pier-head, which shows *red* to the southward and *white* to the northward, the change occurring at the bearing E.S.E.

Tidal lights.—In a sloping field, just above the inner end of the south pier, are two moveable white leading marks which, when kept in line, lead in; at night *fixed white* lights are exhibited from these marks when required, when there is sufficient depth for vessels whose draught admit of taking the harbour. During the fishing season, 1st September to 30th November, two *fixed red* leading lights for the bar are exhibited.

Tidal Signals.—Directions.—When there is a depth of 9 feet on the bar a black ball is hoisted at the yard arm of the flagstaff; and a red flag with white letters is hoisted at the masthead, when there is sufficient water for vessels to enter the harbour during daytime.

Pilots, with boats and warps, are ready at tide time, and there are capstans on each side of the entrance to assist sailing craft.

A vessel in extremity, and unable to enter the harbour, should endeavour to beach near the pier at the north-east end of the town.

Tides.—The streams off Aberystwith are not strong, seldom running at a greater rate than half a knot. It is high-water in the harbour, full and change, at 7h. 30m. local, 7h. 46m. Greenwich; springs rise $13\frac{1}{2}$ feet, neaps 10 feet.

Lifeboat.—A lifeboat is stationed northward of the harbour.

Trade.—Ship-building on a small scale is carried on at Aberystwith, and there are foundries in which small repairs to machinery may be effected. General supplies may also be obtained, and good water from the channel of the Ystwith. Steam communication is kept up with Liverpool, Bristol, and the intermediate ports. The chief imports are coal, culm, limestone, and timber; and the exports, bark and lead ore. Aberystwith is in connection with the general lines of railway, both north and south.

The population in 1881 was 6,664. The coasting trade annually amounts to about 27,000 tons inwards, and the same outwards.

SHOALS northward of Aberystwith.—Clarach patch.—From Aberystwith the coast trends north-eastward to Borth point or Craig-y-Wilfa, rather less than 4 miles, and, with the exception of the low and marshy vale of Clarach, it is bold and rocky, consisting of cliffs from 20 to 120 feet high. Besides the great reef, the Sarn Gynfelin, which projects from the coast in this interval, there is the Clarach, a patch of foul ground, with only 2 feet water, stretching off for half a mile from the foot of the cliffs on the north side of the vale of Clarach. Half or more of Aberystwith south pier open of Castle point, bearing S. by W. $\frac{1}{2}$ W., leads westward of it in about 9 feet least water.

GYNFELIN PATCHES.—At $2\frac{1}{4}$ miles northward of Aberystwith, that extraordinary and dangerous shoal named the Sarn Gynfelin, or Gynfelin patches, begins at the gorge of a deep ravine abreast Wallog farm house. It begins as a narrow tongue of shingle and pebbles intermixed with large stones, named Sarn Wallog, which stretches out in a W.N.W. direction, and dries at spring tides for the

distance of one third of a mile, but is covered throughout its whole extent when the water has risen from 6 to 8 feet. For the next 2 miles it is known as the Sarn Gynfelin, and farther out as Gynfelin patches to the distance of $6\frac{1}{2}$ miles off shore.

Inner channel.—From the outer low-water extreme of the Sarn Wallog, the shallow water continues in about the same direction, with from 3 feet to $1\frac{3}{4}$ fathoms at low-water, to one mile from the shore, where it deepens to 2 and $2\frac{1}{2}$ fathoms, forming an inner swashway half a mile wide. The leading mark for this channel is the monument on Pen-y-Dinas, in line with the main part of the ruin of Aberystwith castle, bearing S. $\frac{1}{4}$ E. (View E., chart 1,411).

Main channel.—Westward of the inner channel, the Sarn again rises in two patches of $1\frac{1}{4}$ and $1\frac{3}{4}$ fathoms least water, and at $2\frac{1}{4}$ miles from the shore again becomes lower, deepening to 2 and 3 fathoms. In this, the main channel, the breadth from the westernmost of the patches just mentioned, to the inner end of the Gynfelin patches, is one mile, and the depth from 2 to 5 fathoms at low-water springs. The latter depth is upon its western side, for which there is no good mark, but Pen-y-Dinas monument well open northward of Harbour pier light, bearing S.S.E., will lead through in not less than 3 fathoms.

Patches.—Upon the eastern end of the outer portion, known as the Gynfelin patches, there is not more than 3 feet water, with Pen-y-Dinas monument in line with the lighthouse; but half a mile westward the depth increases to $1\frac{3}{4}$ fathoms, and so, as a narrow ledge, it continues for one mile, where occurs another swashway with from $2\frac{1}{4}$ to $2\frac{3}{4}$ fathoms, but too narrow and too close to the stones of the Outer patch to render it a safe channel.

Outer patch.—At the eastern end of Outer patch, the western end of the Gynfelin, are three large stones. One of them, measuring from 15 to 20 feet across, had quite the appearance of being a mass of ruin.* Aberystwith castle point bears S.E. by E. $4\frac{5}{8}$ miles from it.

Outer patch is $1\frac{1}{2}$ miles in length, by one mile in width, within the 3-fathoms boundary. At the east and west extremes are boulders with $1\frac{1}{2}$ to 2 feet water, with patches of 4 to 6 feet between. From the west extreme Pen-y-Dinas monument bears S.E. $\frac{1}{2}$ E., distant $6\frac{1}{4}$ miles. The north and west extremes of the bank fall quickly into 5 fathoms.

Buoy.—A red conical buoy with staff and globe, marked "Patches," lies in 7 fathoms off the western edge of Outer patch, with

* These stones formerly uncovered at low water springs, but are now covered.

Aberystwith church, just open northward of a high house in front of it, bearing S.E. by E., easterly, distant 6 miles, and Causeway buoy N. $\frac{1}{4}$ W.

Clearing marks.—The Gynfelin patches project so far from the shore that it is difficult to supply good marks for avoiding it, should the buoy be adrift.

Bryn Awnlwg house, a conspicuous white building on the summit of the first ridge within Aberystwith, on with the square tower of Aberystwith college E. by S. $\frac{3}{4}$ S., leads southward of the Gynfelin in 6 fathoms water.

To pass northward of the patches, trace the outline of the high land from Aberdovey southward to the culminating point, which is the mountain of Moel Llyn, with two peaks; the northernmost of these peaks open northward of Borth point, bearing E. $\frac{1}{2}$ S. (*see* View G., chart 1,411) will lead 2 cables northward of Outer patch in 7 fathoms at low-water.

To pass westward of the patches, only very distant land, and that but seldom seen, is available, but the following mark is better than none. Llethr, the second peak from the southward of four remarkable mountains northward of Cader Idris and Barmouth, open of the bluff land southward of Barmouth, bearing N.E. $\frac{1}{4}$ E. (View I., chart 1,411) will lead nearly 2 miles outside of all, in 9 or 10 fathoms, over a rough stony bottom. Cader Idris in line with Foel Wylt, a remarkable dark peak over Dysynni valley, bearing N.E. by E. $\frac{3}{4}$ E., leads 2 miles westward in 10 to 12 fathoms.

General directions.—In the neighbourhood of the Gynfelin patches, the armed lead should be kept constantly going, and though no distinct directions connected with the depths and quality of the ground can be given, the seaman must be cautious in misty weather, not to approach it at the period of low-water into a less depth than 8 fathoms. At a little distance to the northward of Gynfelin patches, in what may be called Aberdovey bay, the depths are regular over a bottom of sand, but farther out, and for a considerable distance round the outer Gynfelin, stones and sand alternate with such irregularity, that the nature of the bottom serves but little purpose in determining the position. Sailing vessels should avoid this part of Cardigan bay, for as the wind frequently flies round from southward to West and W.N.W., bringing in a heavy sea, escape on either tack would probably be difficult.

Tidal streams.—The streams have no great velocity in this part of Cardigan bay, the springs only running one knot, and the

neaps half that rate. They are sufficiently strong, however, to cause a considerable rip over the shoal with the wind against tide, but in fine weather there is only a slight ripple throughout its whole extent. The direction of the stream is, however, much influenced by the Gynfelin; to the southward the flood sets about East, whereas outside and to the northward of them, it varies from N. by E. to N.E. Abreast the fairway buoy to Aberdovey harbour, its course is about North, and following the direction of the coast, it sets over the Sarn-y-Bwch, and from thence into Barmouth bay.

The ebb stream may be said to have a general south-west direction both in Aberdovey bay and near the Gynfelin, and, whether outside the shoal, or inshore and to the southward of it, it continues south-west to near New Quay, whence it sets nearly West.

Off the Gynfelin patches the flood or northern stream begins $1\frac{1}{2}$ hours before low-water at Liverpool, and runs until $1\frac{1}{2}$ hours before high-water at that place; within and northward of the Gynfelin the streams turn half an hour earlier.

Coast.—Borth.—Near Borth point, upon the side of the hill, is the old village of Borth, and below it, extending about one mile along the shore, the new town, which is much resorted to in the summer. The homœopathic hotel at the north end is a conspicuous object. A considerable number of fishermen are located here.

Lifeboat.—There is a lifeboat at Borth.

From Borth point, or Craig-y-Wilfa, the coast, after falling in to the eastward for about a quarter of a mile, turns abruptly to north-north-eastward for 3 miles to the mouth of the Dovey; within the shore line, composed of shingle and sand, is the extensive morass of Cors Fochno. The high land, leaving the coast at Borth point, skirts the morass on its south side, while the morass forms the southern boundary of the river Dovey for the last 5 miles of its course.

The low-water shore north-north-east from Borth point is fine hard sand, averaging a quarter of a mile in breadth, and having its surface interspersed with roots of trees, the remains of an ancient forest.

RIVER DOVEY, or Dyfi, issuing at Aberdovey, and having its origin in a mountain lake on the east side of Arran Mowddwy, elevated 2,972 feet, passes through a wild and rocky mountain region to the village of Llan-y-Mowddwy and Dynas Mowddwy, and, on by mountains less precipitous, past Aberangel to the village of Cemmes; where, besides several other tributaries, it is joined by the Twymyn, and flowing through a pleasant valley and round Dinas rock, reaches

Machynlleth, the capital of western Montgomeryshire. Near it, the Dovey is joined by the Dulas from the north, and farther on, from the south-east by the Llymant; then, as an enlarged stream, it flows under the little trading village of Garreg, and, sweeping round a headland, becomes an estuary broad and straight, and joins Cardigan bay just below Aberdovey.

The total length of the river is about 30 miles, of which it is navigable at high water for small craft for about 12 miles from its mouth, but the channel is changeable and known only to the pilots.

ABERDOVEY HARBOUR.*—The estuary of the Dovey has a considerable expanse at high water, being one mile wide at its entrance, $1\frac{1}{2}$ miles in width farther in, and ending at 5 miles from the sea. The estuary is bounded on its northern side by rugged uncultivated hills rising steeply to the height of 927 feet, the south by the Cors Fochno, the extensive marsh before mentioned; and the whole of it at low-water is one mass of sand, excepting the channel of the Dovey.

Depths.—The outlet of the river forms the harbour of Aberdovey, which is mainly under the control of the Cambrian Railway Company; it is one cable in width at low-water between the sandbanks, which dry from 10 to 12 feet on either side, with depths of 2 to 4 fathoms over a length of about three-quarters of a mile; vessels of about 17 feet can lie afloat in the pool abreast the pier, one mile within the bar.

The **bar** is about half a mile in length, with a depth of 4 to 5 feet at low-water springs, and 18 to 19 feet at high-water springs, but the depths and direction of the channel are subject to constant changes, rendering the services of a pilot advisable. The buoys are altered to meet these changes.

Strong south-west winds cause a considerable sea on the bar.

Pier.—The pier at Aberdovey is 400 feet in length, and fitted with steam cranes and other appliances for discharging vessels direct into the railway trucks which run on to the pier. It has a depth of 12 to 14 feet alongside at low-water springs.

Occasional lights.—From a structure on Mynydd Bychan, north side of Dovey river, is exhibited, at an elevation of 117 feet above high-water, *only* when steamers trading between Waterford and Aberdovey are expected, a *white* light showing a flash *every five seconds*, visible seaward, between the bearings of North and South, from a distance of 15 miles. Small leading lights are exhibited when a vessel is about to enter, the positions of which depend on the line

* See Admiralty plan of Aberdovey, No. 1,487; scale, $m = 4\cdot0$ inches.

of best water over the bar; also a light on the pier. These are extinguished when done with.

Buoys.—Three buoys usually mark the south side of the channel over the bar, namely:—Outer buoy, black conical, in about 4 fathoms; red conical bar buoy in about 7 feet, marking north edge of South spit; and a black and white chequered buoy in about 10 feet on south extreme of bank forming north side of channel.

Tides.—It is high water, full and change, at Aberdovey, at 8h. 0m. local, 8h. 16m. Greenwich; ordinary springs rise 15 feet abreast the town.

The flood stream in the river turns at the time of high water by the shore, and runs for $4\frac{3}{4}$ hours; it is much weaker than the ebb, which varies from 3 to 4 knots an hour, according to the freshets in the river, and runs for $7\frac{1}{2}$ hours. At the outer buoy, the flood stream sets north across the entrance at the rate of three-quarters of a knot, and the ebb in about an opposite direction.

Anchorage.—A vessel waiting tide to enter Aberdovey harbour may anchor anywhere off the bar, in depths of 4 to 5 fathoms, sand over stiff mud, as the ground is clear. Pen-y-Dinas monument, just open of the land northward of Aberystwith, will keep a vessel well clear of the Dovey bar sands.

Pilots are always in readiness at tide time during daylight, to proceed to a vessel by boat, and if the weather should be too severe for the pilot boat to get alongside they place their boat as low down towards the bar as practicable, and their signals are to be attended to.

Directions.—In entering the harbour the set of the tide across the bar channel must be guarded against; at half flood, when there is about 11 to 12 feet on the bar, and small craft might enter, the stream sets about E.N.E. Towards high water, when the banks are nearly covered, the stream sets about N.N.E., or directly upon the north sands. At half a mile within the bar, however, the flood takes a more direct course up the river.

Approaching the bar, the town of Aberdovey may be steered for when bearing E. by S., which will lead to the outer or Fairway, which should be left about half a cable on the starboard hand, and course steered to pass close northward of the red conical buoy, from which an E. $\frac{3}{4}$ S. course will lead in mid-channel southward of the chequered buoy, thence to the harbour buoy. The course, however, must depend on the positions of the buoys, as any instructions founded upon information, now correct, might in a short time only mislead.*

* Information from Staff-Commander W. E. Archdeacon, 1890.

Here will be found from 2 to 5 fathoms at low water, over sandy ground; but there is not space enough in the pool for more than half a dozen vessels to lie afloat at low water, and the tides are occasionally very strong, rendering it necessary to moor. Coasting craft, however, may safely berth on the strand abreast Aberdovey.

Beaching.—If, from the loss of masts, or other circumstances, a sailing vessel is unable to maintain an offing, the best place for beaching is abreast the farm of Moel Ynys, more than one mile to the southward of the bar, where, if the beach be taken towards high water, vessels of small draught will receive but little injury.

Aberdovey town is a pretty and pleasant little watering place, consisting of one long straggling street close to the water. Fronting the town is the pier in connection with the railway. The scenery on either side of the estuary is of a lovely character, wooded banks backed up by high ranges of mountains.

The **railway** station is close to the harbour, and by means of a short branch trucks are run on to the pier. There is also a large wharf with sidings for shipping slate. A ferry crosses here.

Trade.—Aberdovey is a shipping port for some lead mines and slate quarries in the Corris mountains. Trade is being developed by the steamers trading to Waterford. Two hundred and six vessels entered the port in 1888, of the registered tonnage of 35,114 tons. Small supplies of coal are available.

Population in 1881 was 1,200.

Lifeboat.—A lifeboat is stationed at Aberdovey.

COAST.—Towyn.—At the north side of the entrance to the Dovey, the high land of Mynydd Bychan, before referred to, approaches to within a quarter of a mile of the sand-hills forming the point; Corland Fraith, situated $2\frac{1}{2}$ miles north-eastward of the point, is elevated 1,326 feet; farther north the high land recedes from the coast, which becomes low and marshy. At the foot of the hills $2\frac{3}{4}$ miles northward of the Dovey, and three-quarters of a mile from the coast, is the market town of Towyn, with a fine old church and tower; but from standing low it is not conspicuous from the sea. Some large bathing houses upon the shore abreast are prominent.

Pen Bwch beacon.—Dysynni river, a small stream entering the sea about one mile northward of Towyn, is available for boats at high water. The Welsh coast railway crosses its mouth and continues along the shore to Barmouth. The high land again

approaches the coast on the north side of this river, terminating in the abrupt hill, Pen Bwch, 635 feet in height, on the summit of which is a beacon, painted white.

SARN-Y-BWCH, within a depth of 5 fathoms, projects in a west direction from abreast Pen Bwch beacon, for a distance of 5 miles. It is composed of large loose stones, and at low-water springs it dries in patches for nearly one mile off shore, with depths of one fathom only at two miles distant, beyond which it deepens gradually ; its north and south sides are, however, steep-to.

Buoy.—A black conical buoy, in about 4 fathoms, lies westward of the most dangerous part of the Sarn-y-Bwch, with the beacon on the hill bearing E. $\frac{1}{4}$ N., distant $4\frac{1}{4}$ miles ; a patch of $3\frac{1}{4}$ fathoms, stones, lies half a mile S.W. $\frac{1}{2}$ S. of the buoy.

In the absence of the buoy, the remarkable low hill Ffigle Fawr, south side of Barmouth harbour, just open northward of Borthwen point, which is low, bearing E.N.E. (View C., chart 1,411) will lead half a mile north-westward of Sarn-y-Bwch ; and the rounded hill Foel Wyllt, standing by itself in the valley of the Dysynni, kept well open southward of the bluff point on which Pen Bwch beacon stands, bearing East, will lead southward in about 5 fathoms.

COAST.—**Borthwen point**.—From Pen Bwch, the coast trends north-eastward for nearly 4 miles to Borthwen, where is a low shingle point with a small village. From thence trending east-north-east for $1\frac{1}{4}$ miles, it turns northward towards Barmouth, and in no part should be approached nearer than half a mile by coasting craft, as it is fringed by large stones. The railway runs along the shore, behind which the land rises in a succession of steep and rocky hills, and form the base of Cader Idris.

Patches.—At $2\frac{1}{2}$ and $4\frac{1}{3}$ miles northward of Pen Bwch, and one and $1\frac{1}{2}$ miles off shore, respectively, are patches of 16 and 19 feet, with deeper water around.

RIVER MAW, or **Mawddach**, the outlet of which forms the harbour of Barmouth, rises north-eastward in the parish of Llanuwchllyn, and is a mountain torrent for some miles, augmented by the Eden from the north and other minor streams, and having passed northward of Dolgelly, it shortly after becomes a tidal and navigable river, expanding into an estuary of considerable width.

BARMOUTH HARBOUR.*—The bar, consisting of sand and stones, situated about one mile seaward of the town, has a depth of 2 feet at low-water springs, and about 16 feet at high-water springs, with

See Admiralty plan of Barmouth, No. 1487 ; scale, $m = 4\cdot0$ inches.

deeper water within. It is, however, subject to considerable change, rendering it necessary for strangers to employ the services of a pilot. Strong winds from between S.W. and N.W. cause a dangerous sea on the bar.

The Pool.—Southward of Ynys-y-Brawd, a sandy islet within the bar, is a pool about 2 cables in length by half a cable in breadth with depths of 2 to 4 fathoms, clay, at low-water springs, suitable for vessels of about 8 feet draught; it receives considerable protection from the bank of stones extending 3 cables southward from the islet, and which only covers 4 feet at high-water springs. This anchorage, however, is not recommended when near spring tides, as it is exposed towards high water, nor at any time when bad weather is probable, as a considerable sea sets in.

There is a much safer, though smaller pool near the railway bridge, with a depth of 10 to 15 feet at low-water. The bottom is chiefly shifting sand over rock. A drawbridge of 48 feet span admits vessels to the upper part of this pool and river.

At low water, the channel between Penrhyn point and Ynys-y-Brawd, is less than one cable wide.

Ynys-y-Brawd.—**Beacon.**—Ynys-y-Brawd, though but a small sand islet is of great value to the port, as the two groynes projecting from its south-east and north-west ends materially assist in securing the channel and in covering in the harbour. The south-west extreme of the bank of stones extending southward of it, is marked by a beacon.

Buoys.—The banks at the entrance to Barmouth being liable to change, the positions of the buoys are altered accordingly.

The fairway buoy is black, and lies in 18 feet at low-water springs; it will generally be picked up with Ffigle Fawr nearly in a line with the south face of Cader Idris; about three-quarters of a mile farther in is a red buoy marking the west extreme of the spit which extends westward from Ynys-y-Brawd beacon.

Tides.—It is high-water, full and change, at Barmouth quay, at 7h. 41m. local, 7h. 57m. Greenwich; springs rise 14 feet, neaps about 10½ feet.

As in the case of most estuaries, the tidal streams, particularly that of the ebb, have considerable strength (from 3 to 4 knots at times), and must be carefully attended to, as they cannot be stemmed by sailing craft during springs, except with a strong leading wind.

Outside the fairway buoy, the flood sets N.E. by E., and the ebb about S.S.W., the rate of neither, at that distance, exceeding half a knot.

Anchorage.—Vessels waiting tide, to enter the harbour, may anchor outside the bar, the lead and the state of the tide being the best guides.

Pilots.—The pilots are hovellers, and their charge is by agreement.

Vessels running for the port in heavy weather will always find the pilot-boat lying at the spit buoy to direct them.

Directions.—Vessels may identify the position of Barmouth from the sea, from its having the remarkable mountain Cader Idris to the south-eastward, and the no less conspicuous mountains Moelfre, Rhinog Fawr, and Craig Ddrwg, to the northward of it.

Figle Fawr hill in line with Penrhyn house (the first northward of the flagstaff), will lead nearly to the fairway buoy; thence steer for the spit buoy, passing southward of it; thence steer for the groyne extending south-east of Ynys-y-Brawd, anchoring westward of it in the lower pool, or proceeding thence to the pool at the railway bridge.

Beaching.—In extremity, beach at the entrance of the north-west swash as the best means for saving life.

Barmouth is situated on the north shore of the Maw at the end of a high slate promontory of the Llawllech hills. The small houses of the old town clustering, tier above tier against the cliff, are nearly elbowed out of sight by tall modern streets and villas which occupy the foreshore. Its sheltered position, fine views, and beaches make it an attractive watering place both in summer and winter.

The Cambrian Railway passes along in front of the town, crossing the estuary from Borten point, a little above the town, on a viaduct of wood piles, connecting with an embankment from the south side to the westward of Figle Fawr. There is ferry communication between Barmouth and Penrhyn point on the opposite side of the harbour.

Quay.—There is a landing quay in front of the town, affording accommodation for a few small coasting craft, which lie upon the sand abreast out of the tide. The depths here are constantly changing.

Lifeboat.—A lifeboat is stationed at Barmouth.

Trade.—Supplies.—Good water may be obtained from a small stream in Aberamfrach bay, one-third of a mile above Barmouth; and other supplies may be had in moderate quantities. The principal export is manganese. About half-a-dozen coasting steamers of about 200 tons, enter the port annually, besides small sailing craft.

Barmouth is a creek of Aberystwith. Population in 1889 was 1,940.

COAST.—From Barmouth the coast trends northward for 7 miles to Mochras island, and consists of low sand-hills skirting Morfa

Dyffryn, a marsh of varying width. At the little church of Llanaber, $1\frac{1}{2}$ miles northward from Barmouth, the high land recedes from the coast, taking a direction towards Harlech; at the foot of these hills there are several villages. The shore, a sandy strand, is free from all danger to within $2\frac{1}{2}$ miles of Mochras island, where the Sarn Badrig begins.

Bemar bank, a small patch of large stones about three-quarters of a mile outside high-water mark, has a depth of 4 feet at low-water springs; the depths on either side are about $4\frac{1}{2}$ fathoms.

Mochras spit extends $1\frac{1}{2}$ miles westward of Mochras point. The spit is composed of loose stones, and the least depth found was 4 feet at half-a-mile off-shore, and 7 feet near its outer end.

Badrig east pass is the channel, half-a-mile off-shore, between Sarn Badrig and Bemar bank, and has a least depth of $2\frac{3}{4}$ fathoms. From the southward, the west hump of Moel Gest in line with low extreme of Mochras island, bearing N. by E. $\frac{2}{3}$ E., leads between Sarn Badrig and Bemar bank; when Moelfre mountain, a large round-topped mountain, and the nearest to the coast, bears E. by S., steer W. by N. until Moel Gest is in line with the distant mountain, Moel Hebog, N.N.E. $\frac{3}{4}$ E., which mark leads westward of Mochras spit.

SARN BADRIG,* or CAUSEWAY.—This remarkable shoal projects 10 miles from the Merioneth shore, obstructing the navigation of that part of Cardigan bay, and to any sailing vessel embayed between it and Barmouth in a westerly gale, escape seaward would be almost hopeless. During fine weather the edge of the shoal is denoted by the ripple or overfall of the tide, which runs across it with considerable velocity, and in strong winds a heavy sea breaks upon it. The Sarn Badrig appears to be generally composed of large loose stones, and, though the ridge is very narrow, its outer end is an extensive patch of rocks and stones, one of which dries $1\frac{1}{2}$ feet at low water springs. Two prongs, each about one mile in length, with depths of 6 to 9 feet, and steep-to, project from the rock which dries.

Four cables eastward of that rock, is another rock just dry at low water; thence for $1\frac{1}{2}$ miles the depths are from one to 3 feet on the top of the ridge. This is succeeded by a swashway $1\frac{1}{4}$ miles in width, with depths of 7 to 9 feet; it has a patch nearly midway of 3 feet. The ridge thence re-appears, with depths of one to 3 feet as before, for about $2\frac{3}{4}$ miles, or to 6 miles from its outer end. Here it becomes a bank, dry 2 feet at low water, to within half-a-mile of its east extreme, whence it drops suddenly to 3 and 4 fathoms in Badrig east pass.

* St. Patrick.

The Causeway is comparatively steep-to on its south side, but on its north-west side the bottom is extremely irregular, there being patches of $2\frac{1}{2}$ to $3\frac{1}{2}$ fathoms some 2 miles from it.*

From the extreme of the west prong of Sarn Badrig, in 3 fathoms St. Tudwall's light bears N. by W., distant $7\frac{1}{2}$ miles, and Bardsey light N.W. by W. $\frac{1}{8}$ W.

Buoy.—A conical buoy, painted black, with staff and diamond, and marked "Causeway" lies 2 miles W. by N. of the west prong of the Sarn Badrig, in about 5 fathoms at low-water springs; with Snowdon in line with Moel Hebog, and Bardsey light N.W. $\frac{3}{4}$ W., distant 14 miles.

The *occulting* light at St. Tudwall island shows *red* over the buoy and the western half of Sarn Badrig, but changes to *white* at half a mile westward of the buoy, on the bearing N. $\frac{3}{4}$ E.

Clearing marks.—The mariner should give the Sarn Badrig a wide berth.

The whole of Rhiw mountain will open to the westward of Penkilan head, bearing N.N.W. (View B, chart 1,411), leads westward of the west prong in about 5 fathoms, midway between it and the buoy; Carn Madryn open westward of Wylfa head, leads westward of the buoy. Rhinog Fach, a table topped mountain (the next one to the southward of the remarkable sharp-pointed mountain Rhinog Fawr), well open northward of Moelfre mountain, or Harlech castle in line with a sudden fall upon the south side of a mountain with a remarkable score in its centre, between Moelwyn and Craig Ddrwg, N.E. by E. $\frac{1}{8}$ E., leads about half a mile northward of the western portion of the Causeway. Rhinog Fach well open southward of Moelfre E. by N. $\frac{1}{3}$ N., leads southward of the south prong.

These are not good marks, as Moelfre is indistinct in certain lights, and the back land is often capped by clouds.

At night.—St. Tudwall's light showing *white*, bearing eastward of N. $\frac{3}{4}$ E., leads westward of Sarn Badrig.

In thick weather, by keeping outside the depth of 10 fathoms, a vessel will not approach within 2 miles of Sarn Badrig.

Tidal streams.—At the outer end of Sarn Badrig the flood stream sets about E.N.E. into Tremadoc bay at the rate of about one knot at springs. The ebb sets S.S.W. at the same rate. The streams

* See Admiralty chart of Sarn Badrig, Sarn-y-Bwch, and Port Madoc, No. 1484, scale, $m = 2\cdot0$ inches.

turn one hour before high and low-water at the entrance to Liverpool. In Tremadoc bay, at 6 or 7 miles off the land, the flood begins about one hour earlier, and runs for $7\frac{1}{2}$ hours.

The stream of flood sets differently upon the opposite sides of Sarn Badrig; half-way in upon the south side, for instance, its direction is about North, which is its general set over nearly the whole of Barmouth bay; but on the north side of the reef it draws towards Tremadoc bay in about a N.E. by E. direction. The ebb stream sets about S.S.W.

COAST.—**Mochras island**, low and narrow, is separated from the morfa, or moor of Diffryn, by Mochras creek, a broad inlet, the sandy bottom of which is uncovered at low-water. The small stream of Afon Artro, which discharges through the inlet, formerly issued at the west end of the island, but its waters have been diverted through a cut made between the east end of Mochras and the low rocky point upon the Harlech side, and this cut is used at high water by the few small sloops which frequent the place, bringing coal and taking away ore.

Harlech castle.—The low swampy coast gives place to cliff one mile north-eastward of Mochras island, and, with a height of about 100 feet, continues to a little beyond Harlech castle, which, standing upon its brink north-east $2\frac{1}{2}$ miles from Mochras, is a conspicuous object from the offing, and useful as a sea-mark. This ruined, but once important fortress, owed its erection, like many others in the principality, to the policy and enterprise of Edward I. It appears to have been quadrangular, with round towers at the angles and at the sides of the principal entrance.

The shore from Mochras island towards the castle is skirted by large stones, dry at low-water, and should not be approached nearer than a third of a mile, but one mile south-westward of the castle, a broad sandy strand turns off from the cliff in a northerly direction and fronting the moor of Harlech for $2\frac{1}{2}$ miles, it then becomes merged in the extensive sands Traeth Bach and Traeth Mawr.

PORT MADOC.—The entrance to the wide estuary, within which is situated the harbour of port Madoc, lies between Harlech point and the small and nearly insulated hill Ynys Cyngar, one mile to the northward of it; at its head a peninsula, about 250 feet in height, divides it into two sandy inlets, Traeth Bach, or the small sands, and Traeth Mawr, or the great sands, both of which dry at one-third to a half ebb. The Dwyrdd river discharges into Traeth Bach and the Glaslyn into Traeth Mawr.

Traeth Bach is only frequented by boats, and for such it is navigable between half flood and half ebb.

Bar.—Depths to town.—Port Madoc, situated $2\frac{1}{2}$ miles above the bar, has depths of one to 2 feet only at low-water springs, but just below Borth point, one mile below, there is a pool with 2 to 4 fathoms water, where small craft can lie afloat, care being taken to avoid Gomer rock, which dries at low-water springs, and is situated about 70 yards off shore at one-cable north-eastward of Fechan point. It is necessary to moor here. There are ring bolts along the shore near Fechan point for the convenience of vessels.

The bar (1889) had a depth of 2 feet at low-water springs and 17 feet at high-water springs, but it is subject to constant change, particularly during south-west gales, rendering it advisable to employ a pilot.

The sands, encumbering the estuary, extend about one mile seaward of a line joining the entrance points, and terminate in Morfa Bychan spit on the north side and Harlech spit on the south side; the extreme of the former is $1\frac{4}{5}$ miles south-westward of Ynys Cyngar, and overlaps Harlech spit, rendering the entrance somewhat crooked.

Buoys.—The buoys are shifted to meet any changes in the channel. A fairway buoy, black conical, lies in about 4 fathoms one-third of a mile south-west of the bar; a black cask buoy on the extreme of Morfa Bychan spit, a black and white vertical striped buoy on the east side of the spit, and within this three other black buoys; these are port-hard buoys on entering.

A small red buoy, with staff and cage, in 6 feet, lies a quarter of a mile north-eastward of the fairway buoy, and a red buoy marks the extreme of Harlech spit; these are starboard-hard buoys. They, however, must not be depended on.

Pilots.—Tugs.—There are seven licensed pilots for port Madoc and two tugs. The pilots, who are always on the look-out towards tide time, signal to the tug masters the approach of any vessel. The tug tows the pilot boat out.

Tides.—It is high-water, full and change, at the bar at 7h. 56m. local, 8h. 12m. Greenwich; springs rise 15 feet, neaps $10\frac{3}{4}$ feet; the tide is 17 minutes later at port Madoc. Outside the bar the rate of the stream is seldom more than three-quarters of a knot, but within it depends much on the extent of sand uncovered.

Lifeboat.—The port Madoc lifeboat is stationed at Crickieth.

Directions.—Port Madoc may be entered at high-water springs with smooth water by vessels drawing 15 feet, and at neaps by those

of 10 feet. In westerly winds sailing vessels bound to the port sometimes anchor in St. Tudwall's road, quitting it in time to save tide in, and also taking a pilot from there; with other winds temporary anchorage may be taken by sailing vessels or others off the fairway buoy.

Harlech castle on the south side, and Moel Gest, a somewhat isolated hill, 854 feet in height on the north side, sufficiently point out the position of the entrance channel to port Madoc. A course East from St. Tudwall's road, or E. $\frac{1}{2}$ N. from one mile off Penkilar head, allowing for tide, will lead to the fairway buoy, as will also Moelwyn mountain when bearing E.N.E. As before stated, black buoys mark the western side of the channel, and red the port; but owing to the shifting character of the entrance between wide-spread sands, due to the occasional heavy on shore sea, and to the freshes, which are heavy in winter, it will generally be the more prudent course to take a pilot.

Town.—Port Madoc is of modern creation, and is due to the enterprise of the late Mr. Madocks, who enclosed a vast extent of the Traeth Mawr by an embankment, and converted a sandy waste into cultivated land; the embankment being nearly one mile long, and the land gained about 7,000 acres. Port Madoc, in close vicinity to the sluices at the north-west end of the embankment, has several quays, from whence quantities of slate from the Festiniog and other quarries are shipped, a railway from the former passing over the embankment. In the channel below Borth, half a mile below the quays, a few vessels may always lie afloat, as before stated.

The Cambrian railway winds round the head of Traeth Bach, and crosses Traeth Mawr on a pile viaduct and embankment between Tremadoc and the port.

Trade.—The exports consist principally of slates and copper and lead ores; and the imports of coal, limestone, American timber, and general supplies.

The value of slates exported in 1888 amounted to £247,000, out of a total of £300,000. 580 vessels entered, of the aggregate registered tonnage of 41,212 tons.

Population 3,540 in the year 1881.

Shipbuilding is carried on to some extent, the vessels built averaging from 150 to 200 tons. Supplies are plentiful, and spring water may be obtained from a pipe at the quay. Weekly communication with Liverpool is kept up by steamer. Port Madoc is a creek of Carnarvon.

COAST.—Crickieth Castle.—From Ynys Cyngar, entrance to port Madoc, the coast trends westward for 3 miles to Crickieth, or Crickieth castle, and the intervening low and sandy coast is interrupted by three headlands, the middle and largest of which, Craig Du, is bold and 156 feet in height; the coast to the westward of the craig is skirted by stones and gravel. Crickieth castle stands upon a bold promontory washed by the sea, and was originally a stronghold of Edward I.; the ruins now embrace portions of three towers, two of them being upon the verge of the rock.

Crickieth is a rising seaside summer resort. There is a landing place close eastward of the castle.

Lifeboat.—The lifeboat at Crickieth is kept in constant readiness; a crew being easily obtained from among the fishermen of the village.

Pen-y-Chain,* situated 3 miles westward of Crickieth castle, is a low but bluff point 60 feet in height, but from being backed by lower ground, it is conspicuous from both sides. The coast is low, and fronted by large stones uncovered at low water. The bay also is foul, a patch of 3 feet being situated half a mile off shore, 2 miles eastward of the point, with shallow ground south-west of it. A rock, with 4 feet least water, lies also about $1\frac{1}{2}$ cables off Pen-y-Chain; and there are two ledges which dry, situated N.E. by E., distant $3\frac{1}{4}$ and 7 cables from the point, at 2 and $3\frac{1}{2}$ cables respectively, off shore. Gimlet rock kept well open of Pen-y-Chain, will clear all dangers to the eastward of the point, with the exception of the rock off the pitch of the point.

PWLLHELI ROAD and HARBOUR.—The road affords temporary anchorage in about $2\frac{1}{2}$ fathoms from a half to one mile E.S.E of the Gimlet, to vessels about to enter the harbour, or during off-shore winds; winds from East to S.W. are the most dangerous.

The harbour is dry at low-water, but vessels of 12 or 13 feet draught could enter at high-water springs, and those of 8 feet at neaps, but it is not well suited to vessels over 8 feet draught. Many hundreds of acres of land, formerly under water, are now secured from the sea by embankments, and are under cultivation; but this enclosure, by reducing the back-water, has had the ill effect of causing the deep water formerly found alongside the Gimlet to give place to an accumulation of sand, whereby the entrance is nearly choked up. The harbour should never be attempted without a pilot, for the mouth is very narrow, and the depth on the bar is variable.

* Pronounced Pen-ukan. See Admiralty chart of Pwllheli road, No. 1505; scale, $m = 4\cdot0$ inches.

The shoals in the approach are not dangerous to vessels about to enter the harbour at tide time, except in south-westerly gales, at which time there is a breaking sea about them.

Gimlet rock and shoals.—The coast, westward of Pen-y-Chain, composed of shingle backed by small sand-hills, forms a small bay, terminated by Gimlet rock, within which is Pwllheli harbour. This rock is a huge mass of granite, with its summit about 140 feet above the level of the sea, and from being at the extremity of a low sandy spit, it appears like an island. Quantities of this stone is being quarried and sent to Liverpool for building purposes.

Shoals in the approach.—The approach to Pwllheli road is encumbered with shallow patches of stones, with depths ranging from 7 to 12 feet.

Pen-y-Chain shoal, with a least depth of 11 feet, extends about 7 cables southward of the coast, at the same distance westward of that point. Carn Madryn, in line with the terrace, and open southward of Gimlet rock, leads southward of it.

Pen-y-Chain outer shoal, with a depth of $2\frac{1}{2}$ fathoms, lies $1\frac{7}{10}$ miles S.E. of Gimlet rock. The Garn, open either side of the Gimlet, leads clear of it. Ffridd farm on with Gimlet low north point leads southward.

The Gimlet shoals and Tail patches, with depths of $1\frac{1}{2}$ to 3 fathoms, extend $2\frac{1}{2}$ miles southward of Gimlet rock. There are many other shallow patches within these, of which the plan will afford the best information. Pen-y-Chain, bearing northward of N.E. by E., will lead eastward of all these dangers.

Tides.—It is high water, full and change, at Pwllheli bar, at 7h. 46m. local, 8h. 4m. Greenwich; springs rise $13\frac{3}{4}$ feet, neaps $9\frac{3}{4}$ feet.

At one mile outside the Gimlet the flood sets East, and the ebb about W. by S., the rate at springs being about one knot. The ebb-spring makes there an hour before high water by the shore, but close to the Gimlet it turns nearly two hours before high water, and sets strongly across the mouth of the harbour and round that rock.

Pwllheli town is pleasantly situated, and the surrounding scenery is beautiful and varied. Shipbuilding is carried on to some extent, and it has a fair amount of coasting trade; about 120 vessels entered in 1888. Agricultural produce is exported, and coal and general goods imported. Pwllheli is a creek of Carnarvon.

The population in 1881 was 3,571.

The railway from Tremadoc passes near the shore to Pwllheli, and there at present terminates. There is steamer communication with Liverpool about once a week.

COAST.*—From Pwllheli the coast trends westward about 3 miles to the foot of Mynydd Tir-y-Cwmwd, or Llanbedrog point, consisting generally of low sand-hills, but, one mile to the eastward of the hill above named, a small rocky promontory, Carreg Dyffed, or Sheep rock, rises to a height of 60 feet.

Oyster bank.—The first part of the low-water shore between the Gimlet and Mynydd Cwmmwd is sand, but the remainder is interspersed with large stones; just northward of Carreg Dyffed these stones dry out half a mile, at which distance an oyster bank projects to the southward. At the distance of three-quarters of a mile from the shore the depth is 3 feet only at low-water springs, and 10 feet at one mile, from whence the edge of the bank turns towards Gimlet rock. As the oyster bank does not extend southward of Carreg Dyffed, it leaves the approach to Llanbedrog point partly unobstructed. The Gimlet, bearing northward of N.E. $\frac{1}{2}$ E., leads seaward of the Oyster bank.

Mynydd Tir-y-Cwmwd, a hill easily recognized, rises steeply from the low ground on the land side to the height of 440 feet, while its foot is washed by the sea. A small pier is situated near its east extreme, and another on its south side. Here small craft lie aground to ship stone from the quarries in the hill.

The small church of Llanbedrog and a few houses stand near its base on the north side, and Llanbedrog mill, a useful mark for St. Tudwall's road, about one mile to the westward.

Abersoch bay.—Between Mynydd Tir-y-Cwmwd and the promontory of Penrhyn-du, a distance of $2\frac{1}{3}$ miles, is the sandy bay of Abersoch, the low point and village of that name being situated about midway at the mouth of the Soch. The small stream is resorted to by a few sloops with coal and limestone. The mill of Llanengan, upon elevated ground south-westward of the village, is a useful mark for St. Tudwall's roads.

A Lifeboat is stationed at Abersoch.

Penrhyn-du, a bold promontory 274 feet in height, has its eastern termination in the low point, Porth Bach, in the vicinity of which are several lead mines; its south-eastern boundary, Wylfa head, has a steep rocky face, and is 400 feet high, while its principal projection, Penkilan head, $1\frac{1}{2}$ miles farther westward, projects boldly to the southward, and is usually considered as the northern limit of Cardigan bay.

ST. TUDWALL'S ISLANDS and SOUND.†—Abreast Pen-

* See Admiralty chart, No. 1,411.

† See Admiralty chart of St. Tudwall's roads, No. 1505; scale, $m = 4.0$ inches.

rhyn-du are the St. Tudwall's islands, West island being separated from it by St. Tudwall's sound, 4 cables in width.

West island is about 700 yards in length; its greatest width is nearly 200 yards, and near its centre is 120 feet in height; here is the lighthouse and keepers' dwellings. A shallow rocky ledge extends $1\frac{1}{2}$ cables north-east of the north extreme of the island, with a patch of 16 feet one-third of a mile distant.

East island, about one-quarter of a mile north-eastward of West island, is about 450 yards in length, 200 yards in breadth, and 130 feet high. Shallow water extends about one cable northward of it.

The passage between the islands affords depths of about 4 fathoms at low-water springs, by keeping the East island side of mid-channel.

St. Tudwall's sound, between West island and the shore, is a safe channel for vessels entering or quitting St. Tudwall's road, it being clear on both sides, with a depth of 6 to 8 fathoms. The tides, however, are strong, and when opposed by the wind, cause a short cross sea; but if blowing hard from the northward or westward, it is always advisable to pass through the sound to St. Tudwall's roads.

LIGHTS.—From a circular white tower on West island is exhibited, at 151 feet above high-water, an *occulting* light which shows bright for *eight seconds*, followed by an eclipse of *two seconds*. The light is *white* between the bearings S. $\frac{3}{4}$ W., through south and east, and N. $\frac{3}{4}$ E.; *red* from N. $\frac{3}{4}$ E. to N.W. $\frac{1}{4}$ W.; *white* from N.W. $\frac{1}{4}$ W. to S.W. by W. $\frac{1}{4}$ W.; and *red* from S.W. by W. $\frac{1}{4}$ W. to S. $\frac{3}{4}$ W.; it is, however, obscured by East island, between the bearings S.W. $\frac{1}{4}$ W. and W. by S. $\frac{3}{4}$ S. In clear weather, the light should be visible from a distance of 18 miles.

A *fixed red* light is also exhibited from a window in the same tower, 16 feet below the occulting light, in the direction of Carreg-y-trai, or between the bearings W. $\frac{3}{4}$ N. and W. $\frac{3}{4}$ S.

Carreg-y-trai, a rock nearly one cable in length, and dry 9 feet at low-water springs, is situated 3 cables south-eastward of East island; a reef extends about half a cable from its north and east sides. Wylfa head, open southward of West island, leads southward of the rock; Llanengan mill, open northward of East island, leads northward; and Carn Madryn, in line with the old fanless mill within Llanbedrog, an object not easily mistaken, leads eastward.

A *fixed red* light is shown over the rock from a window in the lighthouse on West island, as before stated, and the position of the rock is indicated by day by a white patch on the cliff of West island, in line with the lighthouse.

Buoy.—A bell buoy, striped vertically black and white, lies in 10 fathoms, 2 cables E.S.E. from Carreg-y-trai.

New patch of $3\frac{1}{2}$ fathoms, stones, lies eastward of Carreg-y-trai, with the lighthouse bearing W. $\frac{3}{4}$ S., distant $2\frac{1}{10}$ miles. Wylfa head, open southward of West island, leads southward of it. St. Tudwall's light, touching south side of East island, leads northward of New patch, and southward of Gimlet tail patches.

St. TUDWALL'S ROADS.—St. Tudwall's roads are protected from winds between S.W., through north, to E.N.E., but with strong winds from South-west, through south, to East, they are exposed to a heavy sea, when it would be difficult for a sailing vessel to obtain an offing. In northerly gales gusts of considerable violence occasionally come off the high land, rendering it advisable to have plenty of cable out.

St. Tudwall's shoal.—Between Inner and Outer roads is a long and narrow sandbank, a continuation of that fronting the shore, stretching southward from Llanbedrog point; it extends to within three-quarters of a mile of East island. Its southern portion, known as St. Tudwall's shoal, is half a mile in length, with depths of 12 to 13 feet. The ridge separating Outer and Inner roads has a depth of 24 feet over a breadth of about 2 cables.

Buoy.—A conical red buoy lies just within the 3 fathoms edge of St. Tudwall's shoal, with Abersoch flagstaff bearing N.W. $\frac{1}{4}$ W., distant one mile.

Outer road.—There is good holding ground in 6 fathoms, sand and shells, in Outer road, with Llanengan mill, bearing W. by N. $\frac{3}{4}$ N., and the lighthouse S.W. $\frac{3}{4}$ W., but there is more sheltered anchorage in 5 fathoms, midway between this position and St. Tudwall's shoal buoy.

Inner road affords good anchorage in 6 to 7 fathoms, sand, with Porth Bach point bearing West, and the lighthouse S. $\frac{1}{2}$ W. Small vessels may anchor farther northward, in 3 to 4 fathoms, on the same bearing of the lighthouse.

Directions.—St. Tudwall's roads are used as a temporary refuge for vessels during westerly or northerly gales. Should the wind back eastward of South, it would be advisable to put to sea, or dependence must be placed upon riding it out. Small vessels may, of course, run for Pwllheli at tide-time.

There is no difficulty in entering either road; Inner or Outer road may be entered from the southward through St. Tudwall's sound, which, with the exception of the ledge extending northward of West island, is free from danger. Towards low water, however, vessels above 18 feet draught wishing to anchor in Outer road, should do so.

from the eastward. Wylfa head kept open southward of West island, until Carn Madryn is on with the old mill westward of Llanbedrog mill, will lead northward of Carreg-y-trai should the buoy be adrift, and well westward of New patch, when anchorage may be taken as before directed.

At night, there is no difficulty in entering the roads through St. Tudwall's sound, provided the weather be clear. If entering from the eastward, the only danger is the Carreg-y-trai, over which a *red* sector of light is shown ; it is also marked by a bell buoy.

Tides.—It is high water, full and change, at St. Tudwall's roads, at 7h. 45m. local, 8h. 3m. Greenwich ; springs rise 14 feet, neaps $9\frac{1}{4}$ feet.

Coast.—Between Penkilan head, the southern projection of the promontory of Penrhyn-du, and Pen-y-kil at the entrance of Bardsey sound, a distance of 7 miles, are the bays of Porth Neigwl, Cadlan, and Aberdaron ; the intervening coast is free from off-lying dangers.

PORTH NEIGWL or NIGEL.—Immediately westward of Penkilan head is the large bay, Porth Neigwl, more commonly known as Hell mouth ; it affords anchorage in 10 to 12 fathoms, at one mile off shore, but it should be used only during off-shore winds or for a tide, as it has a strong indraught, and is exposed to the prevailing south-west winds, which quickly cause a heavy sea, rendering it both difficult and dangerous for a sailing vessel to work out.

Ynys Gwylan.—Westward of Porth Neigwl is Porth Cadlan, with similar anchorage ; off its western point, the Trwyn or Nose, are the two islets Ynys Gwylan and Ynys Bach ; they are mere rocks, affording pasture for a few sheep. In the passage within them there is a patch of $3\frac{1}{2}$ fathoms, with deeper water around it.

Aberdaron bay, westward of Ynys Gwylan, is one mile deep and wide ; it is well sheltered with the wind from N.W. through north, to East, and vessels may anchor in it for a tide in fine weather, but as the holding ground is bad, and the bay is exposed to the heavy sea which on this coast frequently precedes a southerly wind, it cannot be recommended. There is a patch of $4\frac{1}{2}$ fathoms westward of its centre, but the average depths are 6 to 8 fathoms, over gravel and sand.

From Pen-y-kil the coast trends north-westward to Braich-y-Pwll head, forming the northern side of Bardsey sound ; with the exception of Carreg Du, a large rock above high water, situated one-third of a mile westward of Pen-y-kil, the coast is clear. Within the rock is a channel, about one cable wide, which may at times be advantageously used by coasters. With the slightest wind, during the strength of the tide, a dangerous tide rip extends a considerable distance off Pen-y-kil.

CHAPTER IX.

BARDSEY ISLAND TO THE SKERRIES.

VARIATION IN 1891.

Off Bardsey, $19^{\circ} 40'$ West. Off the Skerries, $19^{\circ} 40'$ West.

BARDSEY ISLAND* is separated from the south-west extreme of Carnarvonshire by Bardsey sound. The length of the island from north-east to south-west is $1\frac{1}{2}$ miles, and its greatest breadth, which is at the northern end, is two-thirds of a mile. Pen Dibyn, its south-western extreme, is low and rocky. Mount Bardsey, on its eastern side, is a conspicuous object, rising steeply from the sea to 541 feet in height, and with a bold, rocky, and safe coast at its foot.

The greater portion of the island is under cultivation, and its shores supply lobsters and fish. Population about 80.

Landing.—The best landing-place is on the south-east side of the island in a chasm in the rocks which have been artificially improved; it is marked by a small boat-house. With south-west winds, landing may also be effected between half flood and half ebb on a shingle beach in Porth Solach, on the northern side of the island, but at either place landing should be attempted only in fine weather, except by those well acquainted with the island.

Communication between Bardsey island and the main is by Porth Mewdwy, a convenient boat cove, with a shingle beach, on the west side of Aberdaron bay, where good fresh water may be obtained, and where landing may be effected when it would be unsafe to approach any other part of this coast. They have the means at Aberdaron of making signals to the island, whence a boat with experienced boatmen can always be procured. The passage is dangerous for strangers to attempt.

LIGHT.—From Bardsey lighthouse, a square white tower, 99 feet high, erected near the south-west end of the island, is exhibited at an elevation of 129 feet above high water, an *occulting, white, half minute* light (light 27 seconds, eclipse 3 seconds), visible in clear weather at the distance of 17 miles, in all directions, except where the high north-eastern part of the island intervenes. In Carnarvon bay, also, by the interception of the land, the light is not seen when bearing westward of S.W.

* See Admiralty chart, England, west coast, New Quay to Holyhead, No. 1,411; scale, $m = 0.5$ inch.

Fog signal.—A siren is sounded in thick or foggy weather, giving *three blasts* in quick succession *every five minutes*; the first blast a high note, the second a low note, and the third a high note.

Tugs.—Liverpool tugs and other small vessels, during strong northerly winds, take shelter in the bay under Pen Cristen, north-east of the lighthouse.

Dangers.—Bardsey island may be approached on all sides to within a half-mile. On the south side there is nothing but what is visible at all times of tide, but to the north and west rocks lie off, as follows:—

Maen Bugail, or Stone of Bugail, lies within the Sound one-third of a mile from the north end of the island, with deep water between them; it is very small, and is covered only at high-water spring tides. A heavy race extends nearly half a mile northward of the Stone.

Maen Iau is a half-tide rock, one cable off the west side, and a quarter of a mile from the north point of the island; there is a boat passage between it and the island.

Carreg Rona is a large patch scarcely covered at high-water, situated a quarter of a mile off the west shore, at half a mile north of the lighthouse; but, as there is another patch dry at low water within it, no stranger should attempt the passage.

There is also a patch with $3\frac{1}{4}$ fathoms least water at 2 cables westward of the lighthouse, the neighbourhood of which had better be avoided, as it occasions an overfall, and, at times, a broken sea. There is also a heavy overfall at times over the uneven bottom of 15 to 20 fathoms, $1\frac{1}{2}$ miles north-west of the lighthouse.

Caswenan rock, a pinnacle with 10 fathoms, lies S.W. $\frac{1}{2}$ W., distant one mile from the south point of the island; it is marked by a heavy tide rip.

Ship ledge, half a mile in length, by one cable in breadth, with depths of $5\frac{3}{4}$ to 7 fathoms, and 14 to 15 fathoms around, lies about $2\frac{1}{2}$ cables south-east of Bardsey island; from the shoalest spot, Bardsey lighthouse bears W. by N. $\frac{1}{2}$ N., distant $7\frac{1}{2}$ cables.

As the ebb sets strongly over these rocks, and ledges, the island should not be approached too closely by sailing vessels in light winds.

Devil's ridge, with its centre situated about $4\frac{1}{2}$ miles E.S.E. of Bardsey light, is about $2\frac{1}{2}$ miles in length, north and south, by one mile in breadth; the least depth $4\frac{3}{4}$ fathoms, sand, is on its north-east side, with Bardsey lighthouse bearing W. by N. $\frac{1}{4}$ N., distant $4\frac{3}{4}$ miles; there are spots of $5\frac{1}{2}$ to 8 fathoms on the bank, with 13 to 15 fathoms at a short distance beyond it; during strong winds the overfalls cause considerable sea.

Clearing marks.—St. Tudwall's lighthouse, open of Penkilan head, leads southward of Devil's ridge and Bastram shoal; Mynwdd Anelwog in line with Ynys Bach or Ynys Gwylan leads eastward of Devil's ridge.

Devil's tail is a narrow ridge of rock with a least known depth of 13 fathoms, extending 5 miles in a north-east and south-west direction; its north end with 13 fathoms, lies with Bardsey island lighthouse bearing N. by W. $\frac{3}{4}$ W., distant $6\frac{1}{2}$ miles. Within half a cable of this ridge the depth increases to 22 fathoms, causing during the strength of the tide and bad weather, a heavy race, which small craft should avoid.

Bastram shoal, formed of several rocky parallel ridges, is a more dangerous shoal in the vicinity of Bardsey island, from which its centre bears South, distant about 2 miles. The depths are very irregular, varying from $3\frac{1}{2}$ to 7 fathoms, and many patches of 4 to 5 fathoms lies between its north and south ends, which are about $2\frac{1}{2}$ miles apart; the breadth is rather more than a mile.

From the shallow spot of $3\frac{1}{2}$ fathoms, Bardsey lighthouse bears North, distant $2\frac{7}{10}$ miles.

As there is a depth of more than 20 fathoms around it within half a mile, this shoal causes a great overfall of the tide, and in strong winds a heavy sea; St. Tudwall's lighthouse open of Penkilan head, leads southward of Bastram shoal in about 19 fathoms water.

Leading mark.—There is a good channel, with 15 to 20 fathoms, between Bastram shoal and Bardsey island; Carn Madryn, open of Pen-y-kil, N.E. by E. $\frac{3}{4}$ E., leads through.

BARDSEY SOUND is about $1\frac{1}{2}$ miles wide; the only obstructions are the Carreg Du, which is always above water, on the eastern side; and Maen Bugail, covered at high-water springs only, on the island side as before described.

Tides.—It is high water, full and change, at Bardsey island, at 7h. 40m. local, 8h. 0m. Greenwich, springs rise 15 feet. The tidal streams between Bardsey and Penkilan head, about 9 miles to the eastward, are considerably affected by the shoals; both flood and ebb in certain states of the tide set into the bays of Porth Neigwl or Nigel and Aberdaron, the flood especially has a tendency to sweep a vessel towards Ynys Gwylan; care must, therefore, be observed in a sailing vessel to avoid becoming embayed in either of these bights.

The flood or northerly stream through Bardsey sound, runs about N.N.W., or fairly through, with a velocity of 6 knots at springs;

it commences $3\frac{1}{4}$ hours before high water at Bardsey, or one hour before low water at Liverpool, and runs for about 6 hours; the ebb in the opposite direction.

On the Carnarvon shore, the flood sets inside Ynys Gwylan, around Aberdaron bay, washes the rocky foot of Pen-y-kil, and thence along the Carnarvonshire coast within Carreg Du; this portion of the flood stream turns at high and low water by the shore, nearly two hours earlier than the stream in the middle of the Sound, so that a vessel may take advantage of it when bound north-eastward through the Sound; similarly with the ebb, when bound south-eastward, as it makes 2 hours earlier than the Sound fairway stream.

The flood splits on Bardsey island, uniting again about $1\frac{1}{2}$ miles northward of it, between which and the north end of the island there is a back set or eddy to the island; this eddy occurs off the south end on the ebb, to about 2 miles distant from the island.

Beyond the distance of 2 miles north-west of Bardsey sound, the flood stream runs north-east, and the ebb south-west, with a velocity of 2 or $2\frac{1}{2}$ knots per hour, the flood commencing about low water at Liverpool; within that line it runs from and to Bardsey sound, as before stated.

Directions.—Bardsey sound is used by coasting steamers and sailing craft acquainted with the locality; but strangers should not use it except the tide is favourable. With the wind against tide, there is a strong race round Braich-y-Pwll, and a heavy sea and overfall near Tripod bank. Near Carreg Du, the race is at all times dangerous to boats, except for a few minutes during slack water.

CARNARVON BAY is formed by the north coast of Carnarvonshire and the west coast of Anglesea, which nearly unite at the head of the bay, where is the western entrance to Menai strait. The horns of the bay, namely, Bardsey island and South Stack, are marked by excellent lights, which bear from each other about N.N.E. $\frac{1}{2}$ E. and S.S.W. $\frac{1}{2}$ W., $33\frac{1}{2}$ miles; within that line the bay may be said to be 14 miles deep.

LIGHT-VESSEL.—To facilitate the navigation of St. George's channel, and to indicate to vessels their position when they may be influenced by the indraught of Carnarvon bay, a light-vessel is moored in about 30 fathoms on the line joining Bardsey island and South Stack lights, distant $20\frac{1}{2}$ miles and 13 miles respectively from them, in lat. $53^{\circ}5'40''$ N., long. $4^{\circ}44'30''$ W. The vessel carries a small ball above the usual globe at the mast-head. A red watch buoy lies half a mile eastward of the light-vessel.

From the light-vessel is exhibited, at an elevation of 36 feet above the sea, a *revolving light, every minute*, which shows *two white faces and one red face alternately*, each occupying *twenty seconds*, and visible in clear weather from a distance of 10 miles.

Fog signal.—A fog siren is sounded during thick or foggy weather, giving *two blasts*, low and high, *in quick succession, every two minutes*.

Directions.—By keeping 5 miles or more westward of Bardsey, Stack and Carnarvon bay lights, a vessel will avoid the indraught into the bay on the flood, and be in the true tide, which turns with high and low water at the entrance to Liverpool.

Vessels working into Carnarvon bay from the southward at night, should keep Bardsey light in sight, and in thick weather should not stand into less than 20 fathoms. Those from the northward should keep Stack light in sight, which is visible in over Penrhos point as far as the bearing of N. by W., or $2\frac{1}{2}$ miles off Aberffraw point; in thick weather they should not stand into less than 20 fathoms water.

Braich-y-Pwll head, the north-east point of entrance to Bardsey sound, is a bold rocky cape, steep-to, and about 500 feet in height. From thence the coast to Porth Dynlleyn takes a north-east direction for 12 miles, and the character of the shore continues bold and rocky, having 10 fathoms within half a mile of it, with the following exceptions :—

The Tripod is a bank of sand and shells, with depths of $5\frac{1}{2}$ to 7 fathoms, situated between one and 2 miles northward of Brach-y-Pwll head, and lying nearly parallel with the coast abreast. From its least depth, near the centre, the head bears S. by W., distant $1\frac{3}{4}$ miles. The bank is steep-to, there being from 12 to 18 fathoms within it, and 20 to 30 fathoms at a short distance outside it.

The tidal streams produce overfalls on the bank, and with the wind against tide, a considerable sea.

Bardsey lighthouse, kept southward of S.S.W. $\frac{1}{2}$ W., or open of the north-west point of the island, leads westward of the Tripod; Carreg Du, in sight, leads southward of it.

Carreg Allan is a rocky patch of 10 feet between 2 and 3 cables from the shore, $2\frac{1}{3}$ miles northward of Braich-y-Pwll, and nearly abreast two small islets, which are scarcely detached from the main. Bardsey lighthouse, open westward of Braich-y-Pwll, leads outside the rock.

Maen Mellt is a detached rock 20 feet high, and fairly steep-to, situated about 2 cables west of Glas point; the channel within it is frequently used by small craft from the northward going into the little bay of Porth Oer.

Porth Iago.—Abreast Maen Mellt is the little bay named Porth Iago, with a short ledge on its south-west side. It is sometimes used by small coasters for a tide, during southerly winds and fine weather.

Carreg-y-Chad.—Between Maen Mellt and Porth Dynlleyn point the coast is free from danger until within about 7 cables distance from the latter, where, at a quarter of a mile off shore, lies the Carreg-y-Chad, with 4 feet least water, and 3 to 4 fathoms around it. Carreg-y-trai, awash at half tide, lies between it and the shore. Yr-Eiff or Rivel head, open of Dynlleyn point, leads outside them.*

Tidal streams.—The flood stream between Bardsey sound and Porth Dynlleyn sets about N.E. and the ebb about S.W. by W., at a rate of about 2 knots at spring tides. Half-way between and to the distance of 2 miles off shore the streams turn about $1\frac{1}{2}$ hours after high and low water by the shore, and about the same time before high and low water at the entrance to Liverpool.

PORTH DYNLLEYN or DINLLEYN BAY* is formed by a rocky projection of the coast from 60 to 100 feet high, to the distance of half a mile.

The bay shoals gradually to its head, and is clear throughout, with the exception of the large rock, Carreg-y-Chwislen, and affords protection to coasting craft in 3 to 4 fathoms, sand, during off-shore winds; with winds northward of W.N.W., the bay is open. As the foreshore of the bay is flat, the ebb leaves uncovered a broad margin of fine sand throughout the whole of the southern part of it; but there is a rocky ledge near the houses which small vessels must be careful to avoid when beaching.

Carreg-y-Chwislen, situated about 2 cables eastward of Dynlleyn point, dries at the last quarter ebb, and has depths of 4 fathoms at a short distance. It is marked by a beacon, surmounted by a mast and globe, painted red. There is a clear passage, with 3 to 5 fathoms between the rock and the low water patches off the point which, though useful to those acquainted, should not be attempted by a stranger, as the tides are strong; at low-water, however, all dangers are exposed, and then mid-channel may be kept without difficulty.

Tides.—It is high water, full and change, at Porth Dynlleyn, at 8h. 30m. local, 8h. 48m. Greenwich, and the rise of ordinary springs is 16 feet. The general set of the tide in the bay is from the eastward, along shore and out through the passage westward of the beacon, for 9 out of 12 hours. In the bay the rate is moderate, even at springs, but in the sound it then runs 3 knots.

* See Admiralty chart of Porth Dynlleyn, No. 1,122; scale, $m = 3.9$ inches.

Directions.—In making Porth Dynlleyn from the northward, Carn Madryn is an excellent mark, as it is the westernmost mountain of any importance on the Carnarvonshire coast (except the Rhiw), and is insulated by low land. By steering for it, when bearing S.S.W. $\frac{1}{2}$ W. it will lead direct to the anchorage, and if kept in line with the road close westward of the houses at the head of the bay, bearing S.S.W., will lead one cable eastward of Carreg-y-Chwislen, marked by a beacon as before stated.

If approaching from the westward, keep Yr-Eifl or Rivel head open of the point, passing the point at about 2 cables distance, thence eastward of the beacon as before.

Anchorage.—The best anchorage in Porth Dynlleyn is in $3\frac{1}{2}$ fathoms, sand, a little westward of the leading mark, and with Dynlleyn point bearing N.W. $\frac{1}{2}$ W. The bay affords no shelter from winds northward of W.N.W., but with those off-shore, it is a convenient and safe anchorage for coasters. Small vessels that are disposed to beach should be aware that there is no pier to shelter them from north-east winds, for the heaps of stones intended to answer that purpose afford no protection.

Lifeboat.—Porth Dynlleyn is a lifeboat and rocket station.

Nevin bay.—Immediately to the eastward of Porth Dynlleyn is Nevin bay, with a small pier near its western point, off which point, a ledge extends to the distance of one cable at low water. The pier dries at low-water, but it serves to shelter the few trading sloops, and is useful to fishing boats. The bay and the beach skirting it, are of sand, with depths of 2 fathoms only at a quarter of a mile off shore.

COAST. — Aspect. — Yr-Eifl or Rivel mountain.*—The general character of the coast from Porth Dynlleyn eastward for 10 miles, to the river Llyfni, is high land gradually sloping towards the sea; it forms the foot of a lofty and steep range of mountains, the most remarkable of which is the Yr-Eifl, one of the best landmarks for Carnarvon or Cardigan bays. On rounding Holyhead from the northward, it appears as three very sharp peaks, the middle and highest of which, 1880 feet above the sea, slopes rapidly down, and terminates in Yr-Eifl head, a noble and picturesque cliff—the whole forming so remarkable a feature that it is impossible to mistake it, and it therefore serves as an infallible mark for identifying the land, and determining a vessel's position, which is further assisted by the cliff of Carreg Llan, rising almost perpendicularly from the water to the height of 488 feet, $1\frac{1}{4}$ mile south-west of Yr-Eifl or Rivel head.

A patch of 3 fathoms lies half a mile N. by E. of Carreg Llan.

* See Chart No. 1,411.

To the eastward of Porth Dynlleyn and Nevin bays, as far as Trwyntal point, the coast is free from danger, with the exception of the 3 fathom patch above mentioned, and may be approached by the lead; but from thence for 6 miles beyond Trwyntal point, a low shingle beach is uncovered by the ebb, and has large stones scattered over it, some of which are nearly half a mile from high-water mark. It is, therefore, not prudent for coasters, when these stones are covered, to stand into less than 5 fathoms, or to shut Yr-Eifl head in behind the long cliffy point of Trwynytal, outside of which mark there is a clean bottom of sand, or sand and gravel.

At the river Llyfni, the largest of several streams which discharge into the bay, the coast turns northward towards the entrance of Menai strait; the mountains recede from the coast, which then becomes a low shingle beach, and so continues to Belan point.

Gwydir or port Trevor.—A pier, forming a small harbour known as port Trevor, is situated about half a mile eastward of Trwyntal point. It is dry at low water, but there is a depth of 16 feet alongside it at high-water springs. About 36,000 tons of granite setts are shipped from here annually by the Welsh Granite Company, who employ from 300 to 500 men in the quarries near Llanaelhaiarn and Yr-Eifl.

Tidal light.—A *fixed* light showing *red* between the bearings of about S. by E. $\frac{1}{2}$ E. and E. by S.; and *white* between S. by E. $\frac{1}{2}$ E. and S.W. $\frac{1}{2}$ W., is exhibited when there is sufficient water at the pier for the coasting craft which frequent the place.

A Lifeboat is stationed here, manned by the quarry men, who have done good service.

Dinas Dinlle, a small but remarkable hill, 110 feet high, $2\frac{1}{2}$ miles southward of Menai strait, interrupts the monotony of this low coast; it is the site of an old fortress, as its name implies, the general form of which may still be traced.

At the distance of $1\frac{1}{2}$ miles southward of Belan point the coast rises into ridges of sandhills, which continue to that point; the low-water feature is coarse shingle with large stones here and there, and some off-lying patches. The principal of these, the Arianrod, is three-quarters of a mile from the beach, at half a mile northward of the Llifon stream, and uncovers at low water.

The shore of Carnarvon bay is continued at p. 282.

MENAI STRAIT.

General Remarks.—Menai strait, which separates the island of Anglesea from Carnarvonshire, is about 20 miles in length in a north-east and south-west direction, but in many places is not more

than a quarter of a mile in breadth ; this is further reduced to a breadth of less than 300 yards, in that portion between the tubular and suspension Bridges, known as the Swellies, which also is much encumbered with rocks ; here the tidal streams run with a velocity of 7 to 8 knots at springs, rendering the navigation dangerous to any but those with local knowledge and experience.*

Small steamers and coasters only, proceed through Menai strait.

South-west entrance.—Carnarvon bar, at the south-west entrance to Menai strait, has a depth of 7 feet over it at low water springs, and 21 feet at high-water springs, subject to considerable change ; see cautionary note on plan. Vessels can proceed to Carnarvon, 5 miles within, and either anchor off it in 4 fathoms at low water ; or enter the harbour, which has a depth of 14 feet at high water springs, but dry at low water.

North-east entrance, divided by Puffin island into north-east and north-west entrance channels, have respectively 9 and 18 feet at low water springs, and 32 and 41 feet at high water springs, admitting nearly at all times the class of vessel that trades to Bangor or Beaumaris. For North-east entrance, see p. 305.

Friar's road, 3 miles within the entrance, one mile from Beaumaris and $2\frac{1}{2}$ from Bangor, affords anchorage in about 4 fathoms ; 3 miles within this, over flats with about 12 feet at low water, there is anchorage in a pool off Bangor with 6 to 7 fathoms.

Penrhyn harbour, at Bangor, has depths of 14 to 17 feet alongside at high-water springs, and 10 feet at high-water neaps.

TIDES.—General Remarks.—Two tidal waves enter Menai strait, the one from the south over Carnarvon bar occupies 36 minutes in its passage to the Britannia bridge, increasing the rise from 14 feet at the entrance to 19 feet at Pwllfanog ; the wave entering from the north at Menai lighthouse, about $1\frac{1}{2}$ hours later, occupies 11 minutes in its passage to Menai bridge, with the same rise as at Menai lighthouse, nearly 23 feet.

It is slack water between Carnarvon bar and Menai bridge, at about the times of high and low-water at Llanddwyn at the south entrance, the stream running to the south-west for $6\frac{1}{2}$ hours while the water is falling, and to the north-east for $5\frac{3}{4}$ hours while it is rising at that place. The later and greater tide entering the north-east end of the strait, during the last quarter of its flood follows the ebbing south-west wave ; and at its last-quarter ebb allows the flood from the south-west to penetrate to come up as far as Gallows point, near Beaumaris.

* See Admiralty plan of Menai strait, No. 1,464 ; scale, $m = 2.95$ inches.

For the last three-quarters of an hour of the flood at Menai, the tide is rising there whilst it is falling at Pwllfanog, and at high-water at the former place the water there is 4 feet higher than at Pwllfanog, and the stream is running to the south-west at its greatest strength, 7 to 8 knots on springs, and 5 knots at neaps, through the rocky channel of the Swellies between Menai and Britannia bridges.

Similarly, for the last three-quarters of an hour of the ebb, at Menai, the water is falling there, whilst it is rising at Pwllfanog, so that at the time of Menai low-water the water there is $4\frac{1}{2}$ feet lower than at Pwllfanog, and the stream is running to the north-east at its greatest strength, 7 to 8 knots on springs, and 5 knots at neaps, and penetrates to as far as Gallows point.

Throughout the whole distance between Menai bridge and Menai lighthouse, the stream of the last-quarter ebb runs to the north-east, and the last-quarter flood to the south-west, during the rest of the tide there are two streams meeting and parting off Gallows point; they run towards that point during the first three-quarters of the flood, and from that point during the first three-quarters of the ebb.

At Carnarvon Bar it is high-water, full and change, at 9 h. local, 9 h. 17 m. Greenwich; springs rise $14\frac{1}{2}$ feet, neaps $10\frac{1}{2}$ feet; the stream turns with high and low-water by the shore, the ebb running to the south-west for $6\frac{1}{2}$ hours, and the flood to the north-east for $5\frac{3}{4}$ hours. The main strength of the tide is in the direction of the deep water channel to the bar, the ebb outside Belan point having a tendency to set over the southern banks. Outside the bar the flood comes from the south-west and the ebb from the north-west, with a velocity at springs of $1\frac{1}{2}$ knots, neaps three-quarters of a knot. Between the bar and Carnarvon, the rate is 3 knots at springs, and $1\frac{1}{2}$ knots at neaps, except between Aber-menai and Belan points, where it runs 5 knots at springs, and $2\frac{1}{2}$ knots at neaps. At Carnarvon the tide is 27 minutes later; springs rise $15\frac{3}{8}$ feet, neaps 12 feet.

At Dinorwic, about 4 miles above Carnarvon, it is high-water full and change at 9 h. 28 m. local time, about the same time as Carnarvon, but here springs rise 18 feet, and neaps $13\frac{1}{2}$ feet; the stream turns at high and low-water by the shore, the ebb running to the south-west for $6\frac{1}{2}$ hours, and the flood to the north-east for $5\frac{3}{4}$ hours. Velocity, $3\frac{1}{2}$ knots at springs, $2\frac{1}{2}$ knots at neaps.

At Pwllfanog, 2 miles above Dinorwic, the tide is 5 minutes later, with one foot more rise; the stream runs to the south-west for $6\frac{1}{2}$ hours, from half an hour before high-water to an hour before low-water, and to the north-east for $5\frac{3}{8}$ hours, from an hour before

low-water to half an hour before high-water. Velocity, 5 knots on springs, $3\frac{1}{2}$ knots at neaps.

The Bridges.—Between Menai and Pwllfanog, known as the Swellies, where the strait is crossed by the two bridges, the stream runs to the south-west for $6\frac{1}{2}$ hours, from an hour before high-water to $1\frac{3}{4}$ hours before low-water at Menai, and to the north-east for $5\frac{3}{4}$ hours, from $1\frac{3}{4}$ hours before low-water to an hour before high-water at Menai. There is but little slack water between the bridges, about a quarter of an hour at springs, and half an hour at neaps; the stream, after turning, quickly gains its strength of 7 to 8 knots at springs, and 5 knots at neaps. The times and heights are the same as Beaumaris.

At Beaumaris, it is high-water full and change at 10 h. 28 m. local time, 10 h. 44 m. Greenwich; springs rise $22\frac{1}{2}$ feet, neaps $15\frac{1}{2}$ feet; the stream runs south-west for $5\frac{3}{4}$ hours, from 2 hours flood to 2 hours ebb, and in the contrary direction for $6\frac{1}{4}$ hours, from 2 hours ebb to 2 hours flood; velocity, 5 knots per hour at springs, $2\frac{1}{2}$ knots at neaps.

At Menai Lighthouse, at the north end of the strait, it is high-water full and change at 10h. 13m. local time, 10h. 29m. Greenwich; springs rise $22\frac{3}{4}$ feet, neaps $16\frac{1}{2}$ feet; the stream sets into the strait for $4\frac{3}{4}$ hours, from a quarter of an hour after low-water to an hour before high-water, and out for $7\frac{1}{4}$ hours, from an hour before high-water to a quarter of an hour after low-water. Northward of the lighthouse the first of the flood stream sets directly to the eastward, past the north-west entrance.

SOUTH-WEST ENTRANCE.—Llanddwyn island forms the north side of the approach to the south-west entrance of Menai strait, and is joined to the coast of Anglesea at low-water; it is three-quarters of a mile in length by about 300 yards in breadth, and from 60 to 80 feet in height.

Landing, Lifeboat.—On the south-east side of Llanddwyn island, just under the small tower, is Pilot's cove, a convenient little inlet, where boats may obtain shelter under circumstances of emergency, but great caution should be observed in running for it, on account of the rocks and shoal patches lying off this end of the island. A lifeboat is stationed here.

Rocks.—Buoys.—Several rocks lie a short distance off the island; the two most dangerous, with from 2 to 3 feet water, lie S.S.W. $\frac{1}{2}$ W. 3 cables, and S. $\frac{1}{4}$ E. 5 cables from the light; these are guarded by green nun buoys, placed about one cable south-westward

of them. A rock, awash, lies $1\frac{1}{2}$ cables E.S.E. of the low tower, also marked by a green nun buoy, placed close southward of it. A rock, which dries 9 feet, lies close north-eastward of the island; it is marked by a perch, for the guidance of vessels of 6 or 7 feet draught taking the ground on the sand within it.

Clearing mark.—Holyhead mount, open of Aberffraw point, leads well clear of all dangers off Llanddwyn island.

LIGHT.—On the south-west end of Llanddwyn island are two towers painted white. From the north-western one, which has a flagstaff, is exhibited, at an elevation of 50 feet, a *fixed red* light, visible in clear weather between the bearings S.E. $\frac{1}{2}$ S. and N.E. $\frac{1}{2}$ E., from a distance of 5 miles.

Signals.—Pilots.—The commercial code of signals is kept at the lighthouse, and vessels wishing to communicate will be answered therefrom. A black ball is hoisted at the pilot's house as long as there is 10 feet water on Carnarvon bar. Pilots for Menai strait reside here, and are always on the look-out; three are required for the strait, namely, for Carnarvon, the Swellies, and Beaumaris.

Entrance points to the Strait.—The south-western entrance to Menai strait lies between the low shingle points of Aber-menai and Belan, which are $1\frac{1}{2}$ cables apart. The rapid tidal stream between the points keeps them steep-to, and the channel is, consequently, nearly as wide at low-water as at high-water.

Aber-menai point, lying about 3 miles to the south-east of Llanddwyn island, is at high water a narrow strip of sand, $1\frac{1}{2}$ mile in length, but at low water an extensive flat of sand is left dry to the distance of one mile from the coast of Anglesea. At the extreme point, near the ruins of the ferry-house, is a white powder magazine, which is at times useful to the pilots as a sea mark.

Belan point, on the south side of the entrance, is a range of low sand-hills backed by marsh lands, from which the water has been banked out, and there is within it an inlet of mud and sand, with a branch of the Forhyd stream discharging into it. On Belan point is the summer residence of Lord Newborough, the small sheers and flagstaff on which are at times useful sea marks.

CARNARVON BAR, the outer limit of which is about 3 miles westward of the entrance points, connects the extensive banks of sand, dry at low water in places, which front the coast to about that distance. There are depths apparently of about 5 to 6 feet at low water over the bar, 19 to 20 feet at high-water springs, and 15 to 16 feet at high-water neaps. About one mile within the bar,

abreast the Mussel bank, the eastern extreme of which is marked by a perch, the water deepens to 4 fathoms ; off Carnarvon, about 5 miles above the bar, vessels can anchor in about 4 fathoms, or go into the harbour, which has a depth of 14 feet at high-water springs.

Caution.—The bar and banks in the approach, have completely altered since the survey was made in 1872, so that no reliance whatever can be placed on that portion of the plan. The buoys are, accordingly, constantly shifted to meet these changes, and are correct to February 1889 ; vessels should not enter without local knowledge.

Directions.—Buoys.—The fairway buoy, a black pillar buoy, with staff and globe, in about $7\frac{1}{2}$ fathoms, lies with Llanddwyn lighthouse bearing N.E., distant about $2\frac{1}{2}$ miles. From thence the channel over the bar, to Carnarvon, is marked by black conical buoys on the port hand, and red conical buoys on the starboard hand ; the first buoy inside the fairway is a black one ; the two bar buoys following are red ; the next, a black and white chequered buoy, is also to be left on the starboard hand, thence the Mussel bank black buoy and perch are to be left on the port hand ; the remainder of the buoys up to the town are black, and therefore to be left on the port hand. (Similarly, coming southward, towards Carnarvon from the Swellies, black buoys are to be left on the port hand, and red buoys on the starboard hand.)

A black ball on the signal staff at Llanddwyn island denotes a depth of 10 feet or more on the bar, as before stated.

Anchorage.—There is good anchorage off Carnarvon wharves for vessels waiting to go into the tidal basin, in depths of 3 to 5 fathoms.

CARNARVON TOWN, situated 5 miles above the bar, on the eastern bank of the river Seiont, is a borough, corporate and Parliamentary, with a population of 10,258 at the date of last census. This town, with its magnificent castle, the wall of which encloses an area of about 3 acres, was built by Edward I. ; the castle is now in ruins. The walls built around the town, flanked by towers, are in a good state of preservation.

The town is a summer resort of sea bathers.

Trade.—The principal export is slate, amounting on the average to 88,000 tons, of the value of about £120,000 ; the imports are coal, grain, and general merchandise. There are two iron foundry works, and here repairs to engines and hulls of vessels that frequent the port can be effected.

The town is in railway communication with the slate quarries, and with all parts of the kingdom by the London and North-western, Carnarvonshire, and Cambrian railways.

Harbour.—Harbour works are in course of construction at the mouth of the river Seiont, and extending north-eastward along the shore of the strait. One tidal basin, of $4\frac{3}{4}$ acres, with considerable quayage accommodation, is complete; it has a depth of 14 feet at its entrance at high-water springs; the uncompleted portion of about 12 acres are nearly completed.

A low-water landing place has also been completed.

Carnarvon inner harbour, the mouth of the Seiont, admits at high-water spring tides vessels drawing 13 feet, and at neaps those of 10 feet. Besides dredging at the entrance, it is intended to otherwise improve the accommodation of the inner harbour by adding 2 acres to it.

Light.—A *fixed red* light is shown at the western side of the entrance to the tidal basin.

Supplies.—The usual supplies are obtainable; vessels can obtain a small supply of coal in the tidal basin.

Patent slip.—There is a patent slip at Carnarvon 422 feet in height by 37 feet in breadth, adapted for vessels of 400 tons, and a smaller one at port Dinorwic, $3\frac{1}{2}$ miles above.

Lifeboats.—A lifeboat is stationed at Carnarvon, and the Royal National Lifeboat Institution has a boat outside the bar at Pilot's cove, Llanddwyn, as before stated.

Coastguard.—There is a coastguard station at Carnarvon, and also a drill battery.

Dinorwic is a small tidal harbour, an off-shoot of Carnarvon, and $3\frac{1}{2}$ miles north-eastward of it; the port has a large trade in slate, it being the shipping-place for the Llanberis quarries.

Carreg Ginnog.—Between Dinorwic and the Britannia bridge the low-water feature extends less than half a cable from the shore; the water in the channel is from 5 to 12 fathoms deep, with but one danger, Carreg Ginnog, a rocky ledge with 2 feet water, one cable off the Carnarvon shore, and one mile south-west of the Britannia bridge. Admiral Lord Clarence Paget erected, in 1872, a colossal statue of Nelson, on the Anglesea shore, one-quarter of a mile west of the Britannia bridge; the figure is 20 feet in height, on a pedestal of 22 feet, making in all 42 feet above high-water, and, with a beacon which has been placed by the Carnarvon harbour trustees on the railway embankment, answers the purpose of an efficient clearing mark. View A on plan.

The SWELLIES.—Between the Britannia and Menai bridges the distance is about $\frac{8}{10}$ of a mile ; this reach, known as the Swellies, is much encumbered by rocks and islets, which, with its rapid tides, renders the navigation dangerous to any but those with local knowledge and experience.

Gored Goch.—Britannia rock, on which is built the centre pier of the tubular railway bridge, divides the western entrance of the Swellies reach into two channels, the northern one with a depth of 28 feet, being 100 yards wide, and the southern, with 20 feet, 60 yards wide. Nearly one-quarter of a mile eastward of Britannia rock is Gored Goch, two small rocky islets having some houses and a flagstaff on them ; they are surrounded by a salmon weir of solid construction to resist the force of the tide. The channel northward of the islets is generally used by sailing vessels navigating the strait with a foul wind, it being the wider, and the curve in it enabling them to tack advantageously.

Cribbin and Swelly rocks.—Between Gored Goch and the south shore is Cribbin rock, which is separated from the rocks off the former by a very narrow channel with about 2 feet water ; and between the rock and the south shore is a channel 35 yards wide with 9 feet water. For one-sixth of a mile east of Gored Goch the strait is clear for the same distance across, and then occurs Swelly rock, which dries 14 feet at low water ; the main channel, between it and the Carnarvon shore, is nearly 50 yards wide with 20 feet water.

Clearing mark.—The statue of Nelson touching the north side of the north pier of the Britannia bridge leads close to the south edge of Swelly rock ; therefore, when it is shut in, a vessel will be in the channel. View B, on plan.

Penlas and Weltog islets.—North of Swelly rock is a channel 40 yards wide between that rock and a small rocky islet named Penlas. To the north of Penlas is Weltog islet, connected at low water to the Anglesea shore ; and east of Weltog is the island of Llandisilio, which has on it a church and is connected to Menai by a causeway.

Carreg Halan and the Platters.—Eastward of Swelly rock the channel widens to one cable between Carreg Halan, a rock on the north side near the shore, dry 21 feet at low water, and the Platters, dry 2 feet at low-water springs off the south shore.

Clearing mark.—The north pier of Britannia bridge, just open of the Carnarvon shore, leads northward of the Platters, and from thence to Menai bridge there are no dangers.

Directions.—The sands at the south-west entrance of Menai strait being so liable to change, no directions have been given for entering beyond mentioning the general relative positions of the buoys and beacon which mark the bar and channel, p. 279; and as the navigation from Carnarvon to the suspension bridge, a distance of 7 miles, is very intricate, particularly through the Swellies reach between the bridges, any directions here for that portion of the channel would also be out of place. It should never be attempted without a pilot, and experienced men in that capacity can always be obtained.*

COAST OF ANGLESEA.†—Malldraeth bay and inlet, lies close northward of Llanddwyn island, entrance to Menai strait, described on p. 277. The inlet is about 3 miles in length, by a half to one mile in breadth, but it is almost filled up by the Malldraeth sands, which uncover at half-ebb. A stream winding along the northern bank of the inlet is used occasionally by a few small craft.

Malldraeth bay is clear of danger, and coasters may stop a tide in it, with off shore winds.

Sunken ledges.—From Malldraeth bay the coast trends northward for 12 miles to Penrhos point, the south-western extremity of Holyhead island; ledges and detached rocks front the shore in places from a half to $1\frac{1}{2}$ miles, rendering it advisable for strangers to give it a berth of about 2 miles. Some of the off-lying rocks uncover, while others have so little water over them as to occasion a heavy sea in bad weather.

Aberffraw bay, situated 2 miles northward of Malldraeth bay, affords temporary anchorage in 4 fathoms, during off-shore winds. Aberffraw point must be given a wide berth, as a reef, mostly uncovered about half-tide, extends nearly 3 cables off it.

Penrhos point open of Rhoscolyn beacon leads westward of the reef.

Aberffraw village lies at the head of the inlet, which dries at low-water for one mile below it.

CRIGYLL AND CYMMERAN BAYS are encumbered by Ynys Gros and Ynys Welt ledges, which extend respectively a half and three-quarters of a mile from the shore, and dry at low water; an isolated patch, with less than 6 feet at low-water, occupies the centre

* The north-east entrance to Menai strait, is described in pages 305-313.

† See Admiralty chart, No. 1411.

of Cymmeran bay ; this bay offers temporary anchorage for coasting craft in 6 to 8 fathoms, seaward of the patch.

Carreg Coch.—A small rock with 2 fathoms water, and steep-to, lies $1\frac{1}{2}$ miles off the shore of Crigyll bay, with Llanfaelog mill bearing E. $\frac{3}{4}$ N., and Rhoscolyn beacon N.N.W. $\frac{1}{2}$ W. Llanddwyn lighthouse kept eastward of the bearing S.S.E. $\frac{3}{4}$ E., or Rhoscolyn beacon northward of N. by W. $\frac{1}{2}$ W., leads seaward of the rock.

Telegraph cable.—The submarine telegraph cable from Dublin is landed in Porth Tre Castell, Crigyll bay. The landing place is marked by two posts, 50 yards apart, 20 feet in height, painted in red and black bands, and surmounted by red diamonds with white bar across them, on which is painted "Telegraph cable." The posts in line mark the direction of the cable. Tre Castell consists of one farmhouse only.

A lifeboat and rocket apparatus are stationed at Rhosneigir, on the south side of Cymmeran bay.

HOLYHEAD ISLAND, forming the north-west side of Cymmeran bay, is $6\frac{1}{2}$ miles in length, in a north and south direction, with an average breadth of about $1\frac{1}{2}$ miles. Its summit, Pen Gyby, or Holyhead mount, near its north extreme, is 709 feet in height, and a conspicuous mark from all directions ; seaward of the summit are the North and South Stacks, with their light and fog signal stations ; and in Holyhead bay, on the north-east side of the island is the Refuge harbour, all hereafter described.

At the head of Cymmeran bay is the entrance to the narrow channel, dry at low-water, which separates Holyhead and Anglesea islands ; it is crossed by a road bridge at Trepont, and farther north by a road and railway bridge about two-thirds of a mile in length. It is only available for boats.

Rhoscolyn rocks and beacon.—A circular beacon, painted with red and white rings, stands upon the largest of a cluster of rocks, situated about 3 cables from the south part of the bold and conspicuous headland of Rhoscolyn. It is bold-to, but as there is an overfall and a race of the tide a short distance without the outermost rock, it will be prudent to give it a wide berth.

A black nun buoy, in 7 fathoms, is placed eastward of a rock lying southward of the west point of Rhoscolyn cove.

Rhoscolyn bay or cove, in Holyhead island, lies on the north side of Cymmeran bay, within Rhoscolyn head, where landing can be effected when it would be dangerous in any other part about here.

Lifeboat.—There are a few houses on the shore of the cove,

which are inhabited by pilots and fishermen, and a lifeboat is kept in readiness.

Rocks.—**Maen-piscar** is a dangerous rock which dries at last quarter ebb, situated three-quarters of a mile off shore, with Rhoscolyn beacon bearing S.S.E. $\frac{1}{3}$ E., distant $1\frac{1}{2}$ miles. A vessel will be to the northward of the rock when the conspicuous little sandy bay of Penrhos is well open; Llangwyffen or Aberffraw point open westward of Rhoscolyn beacon, leads westward of the rock.

Carreg Hen is a rock which might usually be disregarded were it not that the sea occasionally breaks upon it in bad weather. This rock is very small, and has a depth of 5 fathoms at low-water springs, with 22 fathoms close to all round. It lies with Rhoscolyn beacon bearing E. by S. $\frac{1}{2}$ S., distant 3 miles, and South Stack bearing N. by E. $\frac{1}{2}$ E.

South Stack, in line with Penrhos point, leads nearly one mile within it; Pen Gyby, the highest part of Holyhead mount, open of Penrhos head, leads one mile outside it.

Penrhos point.—**Foul ground** extends $1\frac{1}{2}$ cables off Penrhos point and as there is also a tidal race off the point, it should be given a good berth when passing.

ABRAHAM'S BOSOM.—Between Penrhos point and the South Stack is a small bay named Abraham's Bosom, where Liverpool tugs occasionally seek shelter during strong off-shore winds; it will also be found an advantageous stopping place for small sailing vessels, or steam vessels of low power, during north-east winds when the tide is adverse for rounding the Stack. The best anchorage is in 7 fathoms over a sandy bottom, with the South Stack high light in line with Penlas rock or islet, and the south point of the bay bearing S.W. by S., distant half a mile.*

Foul ground extends half a cable beyond Penlas rock.

Tidal streams.—To the southward of Rhoscolyn the tidal streams are weak, except near the land, but they acquire strength as the South Stack is neared. Inshore, the stream sweeps round the bays, but at about one mile in the offing the ebb sets to the southward and the flood to the northward.

SOUTH STACK is a rocky islet connected to the north-west extremity of Holyhead island by a chain suspension bridge. The islet is about 240 yards in length by 140 yards in breadth, steep-to, and 140 feet in height.*

* See Admiralty chart of Holyhead bay, No. 1,413; scale, $m = 4\cdot0$ inches.

LIGHTS.—From a circular stone building, 91 feet high, which, together with the attached residences, is painted white, is exhibited at an elevation of 197 feet above high water, a *white light revolving every minute*, visible in clear weather at the distance of 20 miles ; the brilliancy is of short duration.

In Carnarvon bay the light is visible as far inshore as the bearing N. by W., over Penrhos point, except in Penrhos bay, where it is cut off by the point.

Occasional light.—During thick or foggy weather, in addition to the main light, there is exhibited from a lantern situated 65 yards westward of it, at an elevation of 90 feet above high-water, a *white light revolving every minute*, visible seaward between the bearings of North and S.W. $\frac{1}{3}$ W., inside of which it is cut off by the land.

Caution.—When a fog is partial, it may happen that both lights will be visible, when, if they do not show simultaneously, they will naturally appear as one light exhibited at irregular intervals.

Fog signal.—During thick or foggy weather a bell is sounded *once every fifteen seconds*. See North Stack fog signal below.

Signal station.—In approaching the neighbourhood of Holyhead, it will be useful to bear in mind that on the South Stack is a telegraph station, having direct communication with Liverpool ; so that during daylight, either by the International (Commercial) Code, or Marryatt's code of signals, a ship being within signal distance may cause her name as well as any intelligence or request it may be expedient to communicate by those means, to be reported at the underwriters' rooms at Liverpool.

NORTH STACK is a detached rock 120 yards in diameter, and situated close off the north point of the bight, one mile across, between it and South Stack ; the coast between is several hundred feet in height and precipitous, affording no landing.

The bight is free from danger, but the bottom is rocky, the streams rapid and irregular, and the races off the Stacks are dangerous to boats ; it cannot be recommended even as a temporary anchorage. A rocky patch of 3 fathoms lies half a cable off shore north-eastward of North Stack, with the fog signal station flagstaff bearing S.W.

Fog signal station.—On the point within the North Stack is a fog signal station, consisting of three houses and a flagstaff, surrounded by a wall, and the whole being white-washed, forms a very conspicuous mark. During thick or foggy weather, a fog

signal is discharged *every five minutes*. The signal is made by a gun being fired every ten minutes, alternately with an explosive report, which may at times produce a louder report than that produced by the gun; the intervals between the alternate reports being five minutes.

See Holyhead breakwater signals, p. 290, and tidal races off the Stacks, p. 290.

HOLYHEAD MOUNT.—Between the Stacks lies Holyhead mount, or Pen Gyby, one of the most useful objects on the borders of the Irish channel, being equally conspicuous from every direction. Its highest point is elevated 709 feet above high water, and on its northern shoulder is one of a series of stations formerly used for telegraphing information to Liverpool.

Porthnamarch is a small bay situated half a mile eastward of North Stack fog signal station, or midway between it and Holyhead harbour; it is free from danger and out of the strength of the tide; coasters may anchor here in fine weather to await the turn of the stream.

HOLYHEAD BAY, contained between the head within the North Stack and Carmel point, is 6 miles across, by about $2\frac{1}{2}$ miles in depth, and affords anchorage in convenient depths, during off-shore winds; it is but little used as an anchorage, as such ample accommodation is afforded by the Harbour of Refuge on its south side, which is available at all times for all classes of vessels.

Within Holyhead mount the land is low, continuing so past the harbour and round to the northward, as far as Church bay, whence the cliffs increase gradually in height to Carmel head (p. 298), backed by Pengarn mount and the slopes in connection with it.

Church bay affords temporary anchorage for coasting craft in from 6 to 8 fathoms, during off-shore winds. Rhyddland mill abreast is a conspicuous mark.

The stone used in the construction of the breakwater was taken from the side of Holyhead mount, facing the Harbour of Refuge, and the quarry is a conspicuous feature in the land.

Shoals.—**Bolivar or Fenwick rock**, with a least depth of 9 feet, is the outer limit of the foul ground, extending about 7 cables off South Porthwan point, Church bay, about $1\frac{1}{2}$ miles north-eastward of Holyhead harbour.

Buoy.—A black conical buoy, in 6 fathoms, is placed one cable south-west of the shallow head, with South Porthwan point bearing S.E. $\frac{3}{4}$ E., distant 6 cables.

George's mill in line with Old lighthouse, bearing S.W. $\frac{1}{2}$ S., leads westward of Bolivar and Clipera rocks to the harbour entrance. The Clipera, and shoals within it, are described with the harbour shoals, p. 289.

Langdon ridge, about 7 cables in length, is a rocky ridge with depths of 7 to 10 fathoms, situated $1\frac{1}{2}$ miles northward of Bolivar rock; from its shoalest part of 7 fathoms, the Skerries light bears N.N.E. $\frac{1}{8}$ E., distant $2\frac{3}{4}$ miles. Strong tide rips mark it both on the flood and ebb.

Carmel rocks, two patches of $3\frac{1}{4}$ fathoms, about one cable apart, lie, respectively, with Mount Carmel bearing E. by S., distant $8\frac{1}{2}$ cables, and E. by S. $\frac{1}{2}$ S., distant $7\frac{1}{2}$ cables; they are marked by heavy tide rips except for a few minutes during slack water. See p. 294 for shoals northward of Carmel head.

HOLYHEAD HARBOURS.—New or Refuge harbour affords partial shelter to a roadstead of 350 acres, and complete protection to a harbour of 260 acres, with a maximum depth of 7 fathoms at low water springs. The harbour entrance, which is about 250 yards in width between the angle of the breakwater and the outer Platters reef, has depths of $5\frac{1}{2}$ to $5\frac{3}{4}$ fathoms.*

This important work, begun in 1848, and opened by H.R.H. the Prince of Wales in August, 1873, is one of great magnitude. It is chiefly formed by a breakwater of rubble-stone, extending seaward in a general E. by N. direction for the distance of $1\frac{1}{2}$ miles; it is in the form of a double curve with its heel resting upon Soldier point; the greater portion of its length has been formed in a depth of 7 to 8 fathoms water.

The New harbour is in charge of a naval officer, an Admiral, who resides at Government house, at the head of the harbour.

Old harbour.—The Old harbour of Holyhead is formed by a stone pier projecting E.S.E. for 400 yards from the south end of Ynys Gyby, with a wooden extension for a further distance of about 170 yards in an E. $\frac{1}{2}$ S. direction; a transverse pier extends about 250 yards in a north direction from the south shore, abreast the outer extreme of the stone pier, affording protection from easterly winds. For lights, see p. 290. The enclosed space is appropriated to the City of Dublin Steam Packet Co. running between Holyhead and Kingston; it has depths of 13 to 15 feet at the lowest tides, with 15 to 16 feet

* See Admiralty chart of Holyhead harbour, No. 2,011; scale, $m = 12.0$ inches, and Holyhead bay, No. 1413. Depth in entrance is from the survey of 1880; some portions of the harbour were reported, in 1889, to have shoaled from one to three feet.

alongside the jetty, where the packets lie afloat; the trains from London run down abreast. The establishment maintained here for the service of postal communication with Ireland includes everything necessary for keeping the packets in the most efficient state.

Inner harbour is entered from Old harbour. It has been formed by the North Western Railway Company, who have deepened one half of the former mud inlet, and reclaimed the other half, thus forming a harbour 2,000 feet in length by 600 feet in breadth, with a least depth of 12 feet in the harbour and alongside the quays, from which their steamers run to and from Dublin and Carlingford. Masonry quays, lighted by electricity, surround the harbour; these are fitted with numerous hydraulic cranes and other appliances for the rapid discharge and loading of their vessels, in connection with the railway system of the United Kingdom. The North-Western Railway Company have a complete yard and foundry for repairing their own steamers and making boilers.

Shoals in the approach.—Outer Platters.—The approach from Holyhead bay into the Refuge harbour is partially obstructed by the Outer Platters, patches of foul ground, with 3 feet least water, lying about 3 cables northward of Ynys Gyby.

Buoys.—A black and white chequered buoy, with staff and ball, in 5 fathoms, marks the north extreme of the Outer Platters; a black and white chequered buoy, with staff and square board, in 4 fathoms, the west side; these mark the south side of the main entrance to Refuge harbour.*

A red and white chequered buoy, in 3 fathoms, marks the south-east side of a 4-feet patch on the Outer Platters, but there are depths of 2 to 3 fathoms three-quarters of a cable south-east of it.

Skinner rock, with 9 feet water, lies about midway between Outer Platters and the ledge dry at low-water, extending three-quarters of a cable northward of Ynys Gyby; a black and red chequered buoy, in about $2\frac{1}{2}$ fathoms, marks its south side.

Carreg Jordan, or Ynys Gyby reef, with a depth of one foot at low-water springs, lies N.E. by E. $\frac{1}{2}$ E., distant one cable from the extreme of Ynys Gyby; a continuous ledge, dry at low water, extends nearly one cable northward of the same extreme.

* These and other described depths in Holyhead harbour are as shown on the Admiralty chart, No. 2,011, where the soundings are reduced to the level of low-water of equinoctial springs, which is about 2 feet lower than that of ordinary spring tides.

A black buoy marks the north end of this ledge in about 3 fathoms, and a similar black buoy, in about $2\frac{1}{2}$ fathoms, lies about 70 yards north-east of Carreg Jordan; these two buoys mark the south side of the channel, with depths of about $4\frac{1}{2}$ fathoms between Skinner reef and Ynys Gyby. A mooring buoy lies in the fairway westward of them.

Inner Platters, with a least depth of 2 feet, lies nearly one cable northward of the old pier inner light, and the same distance eastward of Ynys Gyby, or abreast Stanley hospital; it is scarcely a danger, being out of the track of shipping.

A bank, with a least depth of 19 feet, consisting of loose stones, and about $1\frac{1}{2}$ cables in length, in a north and south direction, lies on the south side of the approach to the Refuge harbour, and in the fairway to the Old and Inner harbours. From the northern head of 19 feet, the breakwater light bears N. by W., distant 6 cables. Deep draught vessels should avoid it at all times.

St. Cyril's church spire, in line or open northward of Ynys Gyby, leads northward of it. Skinner's monument, in line with the outer extreme of Old harbour jetty, leads southward; and the *red* sector of light from the old lighthouse at inner end of same jetty leads westward of the bank.

Clipera rocks, with depths of less than 4 fathoms, all foul ground, extend about 7 cables seaward of Clipera point, and form the east side of the entrance to Holyhead harbours. Patches of one to 3 feet extend as much as 4 cables seaward of the point.

A bell buoy, painted black, in 6 fathoms, lies three-quarters of a cable westward of a 16-foot patch, and S.S.E. nearly 2 cables from a 21-foot patch, with outer breakwater lighthouse bearing W. by N. $\frac{1}{2}$ N., distant $7\frac{1}{2}$ cables, between which is the fairway to the harbours.

George's mill, open westward of Old harbour outer jetty light, leads westward of Clipera rocks.

Stag rock, a small rocky patch, with 13 feet least water, lies in the approach to Old harbour, with the jetty light bearing W. by S. $\frac{1}{2}$ S., distant 2 cables. The rock is scarcely a danger, as there is as much water over it as there is in the Inner harbour.

Skinner's monument, in line with the jetty light, leads north-westward of it; St. Cyril church spire, open on either side of the arch on the inner end of the stone pier, leads clear of it.

Pibeo rocks, south side of entrance to Old harbour, dry at low water in patches to $1\frac{1}{2}$ cables off shore; a small black buoy marks their north extreme in 9 feet water.

LIGHTS.—**Refuge harbour.**—From a circular lighthouse, painted white, 63 feet in height, erected on the outer end of the Refuge harbour breakwater, is exhibited, at an elevation of 70 feet above high water, a *red flashing* light at intervals of *seven and half seconds*, visible in clear weather from a distance of 14 miles. The light, between the flashes, within the distance of 3 or 4 miles appears *fixed*. Vessels passing this light should keep at least one cable eastward of it.

Fog signals.—During thick or foggy weather a bell is sounded *three times* in quick succession at intervals of *fifteen seconds*. When the London and North-Western Company's steamers are due, two explosive rockets are fired in quick succession every five minutes, in answer to the fog signals made from North Stack station.

A gun is fired in answer to a gun from the City of Dublin Company's steamers when one is approaching the entrance.

Old harbour.—From a tower at the end of the wooden jetty, entrance to Old harbour, is exhibited, at an elevation of 20 feet above high water, a *fixed white* light.

Fog signal.—A bell is sounded during thick or foggy weather.

From the tower at the stone pier-head is exhibited, at an elevation of 20 feet above high water, a *fixed red* light, visible between the bearings of S.W. $\frac{1}{2}$ S. and S.S.W. $\frac{1}{4}$ W. ; this sector leads in the fairway, between Bolivar and Clipera rocks on the east side, and the extreme of the Refuge harbour breakwater and the Platters, on the west side.

To mark the entrance to the Inner harbour, there is exhibited at the head of the fish jetty on the starboard hand, on entering, a *fixed red* light, 16 feet above high water ; and abreast it, on the north point of the public quay, is a *green* light, elevated 10 feet above high water.

Should a vessel be seen approaching the Old harbour at night when the mail packet is swinging or the entrance blocked, a *red flashing* light will be burnt on the jetty, and the fog bell sounded ; a *green flashing* light will be shown when the harbour is again clear.

TIDES.—It is high-water, full and change, at Holyhead pier, at 10h. 11m. local, 10h. 30m. Greenwich ; equinoctial springs rise 20 feet, ordinary springs rise 16 feet, neaps 12 $\frac{1}{2}$ feet ; neaps range 9 feet. Springs rise 18 feet above the zero of the soundings on charts, see footnote, p. 288.

Tidal streams.—At one mile to the westward of the South Stack, the flood stream makes about one hour before low water at the

entrance to Liverpool, or a little before low water at Holyhead, setting about E.N.E. for the Skerries, within which line it draws more eastward into Holyhead bay ; it runs with a velocity of 5 knots at springs, and 3 knots at neaps. The ebb of the same strength sets in a nearly opposite direction. The wind against tide causes a heavy sea and dangerous races at times off the Stacks.

At half a mile northward of the Refuge breakwater, the stream runs E.S.E. from half ebb to half flood on the shore, and in the contrary direction from half flood to half ebb ; quite close to the breakwater, the stream sets westward along the coast from half flood to low water by the shore, or for 9 hours.

Holyhead race extends $1\frac{1}{2}$ miles off shore, the most turbulent portion of it being off the North and South Stacks. Winds from north to north-west cause the worst sea, and even in those from south to south-west, concurrently with the height of the springs, it is dangerous to small vessels. With easterly winds, however, there is generally smooth water, except at the strength of the tide. The position of the highest sea in the race is nearly half a mile northward of the Stack lighthouse, over a prong of 10 fathoms ; a prudent seaman will always keep well outside it in bad weather.

Pilots and Tugs.—There are six licensed pilots belonging to the port. Several Liverpool tugs are generally in waiting, their charges being in each case by special agreement.

DIRECTIONS.—Refuge harbour.—Entering Holyhead Refuge harbour is extremely simple, and unattended with risk. Coming from the northward, keep George's mill in line with the Old harbour inner lighthouse, bearing S.W. $\frac{1}{2}$ S., which leads in clear of all dangers on the east side of the bay.

From the westward there are no dangers. In rounding the breakwater, give it a berth of at least one cable, as a strong tide, setting to the westward for 9 hours out of the 12, strikes upon it.

Having rounded the breakwater, steer to the W.S.W., between it and the Outer Platters buoys, when anchorage may be taken in any portion of the harbour at a moderate distance from the breakwater. The bottom is hard, overlaid by a coating of mud ; but as the water is at all times smooth, the holding capabilities are sufficiently good.

Small vessels should proceed to the south-western portion of the harbour, the outer part being reserved for large ships.

There are buoyed passages between the Platters and Ynys Gyby, but a stranger should not use them.

When entering the harbour at night, steer in with the *red* light of the old harbour, in sight, or between the bearings of

S.S.W. $\frac{1}{4}$ W. and S.W. $\frac{1}{2}$ S., when the vessel will be in the fairway for either harbour, and will pass eastward of the outer breakwater light at the distance of one cable or more.

Vessels entering the Refuge harbour should have both anchors in readiness for letting go, and should be careful not to take up anchorage in the entrance, or in the fairway of the entrance along the breakwater, in order to avoid the penalty of being obliged to shift berth.

Vessels disabled, or without ground tackle, may be laid on a beaching ground, eastward of the Trinity House establishment, on the south side of the harbour. The rocky points between which this ground lies are marked by a black beacon perch to the westward, and by a black buoy, with ball, to the eastward; there is also a black beacon perch 2 cables eastward of the buoy marking the north end of a ledge westward of Ynys Gyby.

Old and Inner harbours.—To enter Old harbour, and having arrived abreast the Refuge breakwater, as above, steer about S.S.E., until Skinner's monument is in line with the Jetty lighthouse, when steer in on that mark, passing northward of Stag rock, and round the Jetty as convenient; a vessel can pass southward of Stag rock by keeping the Railway hotel well open southward of the Jetty light, but it is scarcely a danger, except, perhaps, in bad weather, as the depth on it is but little less than that in the harbour.

Sailing vessels entering the Inner harbour should have both anchors clear, and the end of a warp ready; round the jetty with good steerage way, and keep it close aboard to avoid dropping on the rocks to the southward; thence between the public quay on the port hand, and Fish jetty on the starboard hand, into the harbour.

At Night.—It is not advisable to run for the Old or Inner harbours at night, as the Dublin mail packets and London and North-Western Railway Company's steamers arrive and sail between 10 p.m. and 4 a.m. (*see* harbour lights). If necessary to do so, approach Old harbour in the sector of *red* light shown from the Old lighthouse, keeping towards its eastern limit, until abreast Ynys Gyby, when steer to pass a prudent distance eastward of the Jetty light, then round into the harbour.

HOLYHEAD.—The town of Holyhead derives its importance entirely from being one of the principal stations in the great mail route between England and Ireland; it has no particular branch of commerce or manufacture, but is frequented in summer by sea bathers. A large hotel, the property of the London and North-

Western Company, stands at the head of the Inner harbour, and there are others in the town. The spire of the new church of St. Cyril is a conspicuous object.

The population in 1881 was 8,543.

Supplies.—There is one or more hydrants for the supply of water in the Refuge harbour, and within the Old harbour there are similar facilities for watering placed at intervals along the pier. The usual supplies of provisions are obtainable at the town.

Coal may be obtained from either of the two hulks in the Refuge harbour; they generally have about 300 tons. Small vessels coal from alongside them. The North-Western Railway have a large quantity on hand for their own use.

Lifeboats.—Coastguard.—At the coastguard station, south side of Refuge harbour, a rocket apparatus is kept ready for service; and near it a lifeboat is stationed with rockets, belts, and lines. A second lifeboat has recently been established.

Holyhead is the station of H.M. coastguard ship for the West coast of England.

Storm signal.—The storm drum is hoisted on a staff near the coastguard watch-house, by telegram from London; particulars of the expected gale being posted in a window of the watch-house.

Sailors' home.—There is a sailors' home, and also a hospital named the Stanley hospital for seamen.

Graving docks.—There is a government dock in the Old harbour 307 feet in length, by 63 feet in breadth, with a depth on sill of 14 feet at high-water spring tides. The North-Western Railway Company's dock is 402 feet in length, 70 feet in breadth, with a depth on sill of 20 feet at high-water ordinary spring tides. The gridiron in the Old harbour is 350 feet in length, with a depth of 16 feet at high-water springs.

There is every facility for the repairs of the two steam company's vessels as before stated.

CHAPTER X.

SKERRIES TO GREAT ORME HEAD.

VARIATION IN 1891.

Skerries, $19^{\circ} 45'$ West. Beaumaris bay, $19^{\circ} 30'$ West.

SKERRIES.*—The Skerries are a cluster of dark-coloured rugged islets, seven in number, with some detached rocks, lying $1\frac{3}{4}$ mile off Carmel head, the north-east point of Holyhead bay. They extend about half a mile in an east-north-east and opposite direction, and are separated from each other at high water by narrow gullies.

LIGHTS.—Upon the highest of the Skerries stands a circular white light-tower, 75 feet high, from which is exhibited at an elevation of 117 feet above high-water, an *intermittent* light, eclipsed *three times every minute* as follows:—light 50 seconds, eclipse 2 seconds, light 2 seconds, eclipse 2 seconds, light 2 seconds, eclipse 2 seconds. The light is visible at the distance of 16 miles in clear weather, but is masked between the bearings N.N.W. $\frac{1}{2}$ W. and N.W., covering the East Platters rocks (but the reflection of the light will still be seen there).

In addition, a *red* sector of light is exhibited from a window 50 feet below the main lantern, between the bearings W. by S. $\frac{3}{4}$ S. and W. $\frac{1}{4}$ N., covering Ethel and Coal rocks; the former bearing leading $1\frac{1}{2}$ cables northward of the Ethel, and the latter $2\frac{1}{2}$ cables southward of Coal rock.

Fog signal.—A fog siren is sounded in thick or foggy weather, giving *three blasts* in quick succession *every three minutes* in the following manner:—First a high note, second a high note, third a low note.

Dangers around the Skerries.—The Skerries have several outlying dangers:—

* See Admiralty charts, Holyhead bay, No. 1,413; scale, = 4.0 inches: and Holyhead to Liverpool, western sheet, No. 1,170a; scale, = 1.0 inch.

African rock, with 15 feet least water, and 8 to 12 fathoms close around, lies $1\frac{3}{4}$ cables northward of the Skerries, with the lighthouse in line with Pengarn hill, bearing S.S.E. $\frac{1}{2}$ E.; its position is also generally indicated by an overfall. About half a cable northward of Berchan, the east islet of the Skerries, is another small sunken rock.

West Platters.—Two rocks, named the West Platters, lie half a cable southward of Ynys Arw, the westernmost islet; at low-water springs, one rock is dry, and the other has 3 feet over it.

East Platters, a triangular reef, one cable in extent, and dry at low water, with 14 to 15 fathoms around it, lies between the Skerries and Carmel head, with the Skerries lighthouse bearing N.W. by N., distant half a mile.

There are four or more distinct patches of rocky ground, with 8 and 9 fathoms over them, nearly midway between the East Platters and Carmel head, and other patches, named Carmel rocks, with $3\frac{1}{4}$ to 5 fathoms upon them, before referred to, p. 287, from half to three-quarters of a mile off Carmel head. The rapid tidal streams cause heavy overfalls at the East Platters and the patches inshore of it.

West Mouse, an islet, 100 yards across, and about 20 feet high, lies three-quarters of a mile north-eastward of Carmel head. It is rendered more conspicuous by a white pyramid beacon, surmounted by a globe, on its summit. The West Mouse stands on a rocky ridge one-third of a mile in length, with depths of 2 to 5 fathoms, and on which during the ebb there is a heavy overfall.

St. Vincent rock, with a depth of 11 feet, lies on the north-west extreme of the ridge extending westward of the West Mouse, with the summit of Middle Mouse in line with the northern high water extreme of West Mouse bearing E. $\frac{3}{4}$ S., distant from the latter $2\frac{1}{4}$ cables. Patches of 13 feet lie S.W. by S. half a cable, and S. $\frac{3}{4}$ E. one cable, from St. Vincent rock, and a patch of 15 feet with West Mouse beacon S.E. distant half a cable. These patches are steep-to, and should be given a wide berth.

Coal rock, from its outlying position is one of the principal dangers eastward of the Skerries; it is about 20 yards across, awash at low-water springs, with a depth of 5 fathoms over a rocky bottom at the distance of half a cable, all around it.

It lies with the two Coal beacons, on the main, in line with West Mouse beacon, bearing S.W. $\frac{3}{4}$ S., the latter distant $1\frac{2}{3}$ miles; and with the Skerries light bearing W. $\frac{1}{2}$ S.

Buoy.—A black conical buoy, with staff and globe, lies in 12 fathoms, $1\frac{1}{2}$ cable N. by W. of the rock.

Ethel rock, with a least depth of 3 fathoms, is situated on a rocky bank of from 5 to 10 fathoms, one quarter of a mile in extent, at 6 cables N.W. of Coal rock, with Skerries light bearing W. by S. $\frac{1}{2}$ S., distant rather more than 2 miles.

Buoy.—A black conical buoy, in 11 fathoms, is placed one cable N.N.W. of the rock.

Clearing marks.—In the absence of the buoy, the South and North stacks in line, lead $1\frac{1}{2}$ cables northward of Ethel rock, but the South stack might be opened out, with advantage. Lynus point just open of the land leads northward of Ethel and Coal rocks; but the same point in line with the Middle Mouse leads half a mile northward. At night, Lynus light in sight leads northward of them.

Victoria bank, between Coal rock and the coast, has $1\frac{1}{2}$ fathoms over it, is steep-to, and generally marked by a tide rid; it lies with the West Mouse, bearing West, distant $1\frac{2}{10}$ miles, and Kemmaes windmill in line with the beacon on Harry Furlong reef.

Buoy.—A black conical buoy, in 9 fathoms, is placed close north-eastward of Victoria bank.

Tidal streams.—Outside the Skerries the streams turn at high and low water at the entrance to Liverpool, and run with a velocity of $4\frac{1}{2}$ knots at springs, and $2\frac{1}{2}$ knots at neaps; the flood runs in an E.N.E. direction towards the Skerries, East northward of them, thence E.S.E. parallel to the coast. Within the Skerries, the streams turn $1\frac{1}{2}$ hours earlier, and run from 5 to 6 knots at springs, adding considerably to the danger of using this passage.

DIRECTIONS.—The passage outside the Skerries is to be preferred, except in strong off-shore winds, when the inner passage may be taken by attention to the leading marks. Having regard, however, to the broken nature of the ground, together with the rapidity of the tidal streams, it is considered unadvisable for ships of heavy draught to navigate inshore of the Skerries and Ethel rock.

Sailing vessels require a favourable tide for taking the inner passage.

Outside the Skerries.—In passing outside or seaward of the Skerries, it is advisable to give them a berth of at least one mile on account of the increased strength of the tide which prevails near and within them; thence passing northward of Ethel and Coal rocks, with Lynus point in line with or open northward of the Middle Mouse. Thence course may be shaped for the North-west lightship, approach to Liverpool; directions, p. 344.

At night, from the southward, keep South Stack light southward of the bearing S.W. by S., until within about $1\frac{1}{2}$ miles of the Skerries, when course may be shaped more to the eastward, keeping the Skerries *white* light in sight, bearing southward of W. by S. $\frac{3}{4}$ S., until Lynus point light is in sight, when a vessel will be northward of all dangers, and may shape course half a point outside Lynus light; the Skerries light shows *red* over Ethel and Coal rocks.

Inside the Skerries.—Vessels should not pass within the Skerries at night.

During daylight, there is little or no danger in a vessel of moderate draught well under command, but the tides run with great strength, from 5 to 6 knots at times during springs. Some of the dangers are marked by buoys. The marks here given for clearing the several dangers will be easily understood by referring to the chart.

A good route from Holyhead bay is close round Carmel head, passing within Carmel rocks, with the West Mouse touching the head; thence round the head at the distance of about 2 cables, and the same distance or more southward of West Mouse; Middle Mouse in line with Harry Furlong beacon is a good mark for leading southward of West Mouse; thence between Victoria rock buoy and Harry Furlong beacon.

To pass close eastward of the Skerries, keep the suspension bridge at the South Stack in line with the North Stack, bearing S.W., which leads midway between the West and East Platters, one cable inside the Skerries, and three-quarters of a mile westward of Ethel rock.

The two Stacks in line, S.W. $\frac{1}{2}$ W., lead one cable eastward of the East Platters and 2 cables westward of Ethel rock.

A good fairway mark, eastward of the East Platters, is the Middle Mouse in line with the West Mouse beacon, E. $\frac{1}{2}$ S., until Carmel head bears South, when steer to pass a quarter of a mile northward or southward of the West Mouse. If passing northward of it do not shut George's mill or St. Cyril's church spire (if either can be distinguished), at Holyhead, in with Carmel head, or bring the head westward of S.W. by S., until Llanbadrig church is open northward of Wylfa head, which marks lead westward and northward of St. Vincent rock and other patches situated a quarter of a mile westward of the West Mouse; thence pass northward of Victoria rock buoy. Carmel head in line with the West Mouse is a good mark astern.

If passing southward of the West Mouse, steer between Victoria bank buoy and Harry Furlong reef, with Llanbadrig church in line with Wylfa head, as before mentioned ; thence for Middle Mouse.

COAST—Carmel head, the north-east extreme of Holyhead bay is bold and precipitous ; the land slopes with some degree of regularity towards it from Pengarn hill, 550 feet in height, nearly 2 miles distant ; mount Carmel lies just within the head.

Beacons.—Just above the easternmost projection of Carmel head are two white conical beacons, 30 feet high, which, in line with each other, and with the beacon on the West Mouse, mark the direction of Coal rock.

Henborth bay, a rocky bight in the coast, at one mile eastward of Coal rock beacons, is about 2 cables in extent, with a rock named Maen Forchog, in the middle of it, dry at low-water. In off shore winds, coasters may anchor for a tide without the rock in 8 fathoms ; there is no room within. Between Henborth bay and Camlyn point, the coast is fronted by a rocky ledge to the distance of 2 cables ; half-way between the points, at that distance off, is Stag rock, which is seldom covered, and is steep-to.*

Harry Furlong reef.—Beacon.—Off Camlyn point, which is low and narrow, with a flagstaff at the end of it, is a low-water ledge, projecting to the distance of a quarter of a mile, named Harry Furlong reef.

The outer and highest portion of the ledge, is covered at four hours' flood, but it is marked by a pyramid beacon, painted with black and white rings, surmounted by a staff with triangle. Llanbadrig church, touching Wylfa head, leads northward of it.

CAMLYN BAY, situated $3\frac{1}{2}$ miles eastward of the Skerries, is about three-quarters of a mile wide, and skirted at its head by a shingle beach ; it affords good shelter to coasters during off-shore winds, between West and S.E., in 4 fathoms, sand, with the flagstaff on Camlyn point bearing about N.N.W., within the stream of tide. The bay is visited by a few coasters with coal, and the Liverpool pilot-vessels use it as an anchorage in southerly gales, but it should be promptly quitted on a change of wind to the eastward, for a strong breeze from that quarter, with its attendant sea, would render it difficult for a sailing vessel to beat out.

Lifeboat.—A lifeboat is stationed in Camlyn bay.

Mill bay, the eastern part of Camlyn bay, is encumbered with sunken rocks, and of no use even as a temporary anchorage.

* See Admiralty chart :—Holyhead to Liverpool, No. 1,170a.

KEMMAES BAY, contained between Wylfa head three-quarters of a mile to the eastward of Mill bay, and Llanbadrig point, is three-quarters of a mile across, half a mile deep, and affords good shelter in off-shore winds from West to East. The depth of the anchorage is about 5 or 6 fathoms, over a bottom of fine sand, clear of the stream of tide. The shores of the bay are high and rocky, and the low-water line consists of shelving ledges.

Half a cable N.W. by W. from the low-water extreme of Llanbadrig point is a rock having a depth of 6 feet at low-water springs, with 6 fathoms close-to.

The village, creek, and pier of Kemmaes are in the south-east part of the bay. The pier has a depth of 9 to 10 feet within it at high-water springs, affording shelter for a dozen small craft.

Llanbadrig church stands on the point of that name at about 50 yards within the cliffs.

Lifeboat.—A lifeboat is stationed at Kemmaes, as well as a rocket apparatus in charge of the coastguard.

Caution.—It is necessary while using Kemmaes bay as an anchorage to guard against the wind shifting suddenly to the northward. Such a change is of not unfrequent occurrence, and is generally preceded by a swell from that quarter. The safety of a sailing vessel thus suddenly caught must depend on her riding out the gale, or, should she part, on her being able to beach in the partially sheltered creek of Wylfa, under Wylfa head.

MIDDLE MOUSE lies half a mile off Llanlana head, and $4\frac{1}{2}$ miles eastward of the West Mouse. This islet is 200 yards in length by 80 yards in breadth, 23 feet in height, and bold-to all around; it is nearly divided towards its western end by a gully, which gives it the appearance of two islets when seen from the north-eastward.

The channel within the Middle Mouse has a depth of 20 fathoms, and is clear of danger; but near spring tides the rapidity of the stream produces heavy overfalls, especially near the islet.

Clearing mark.—Llynus point light kept in sight leads at least half a mile outside or northward of the Middle Mouse, and of all dangers westward of it.

COAST.—**Llanlana head.**—From Llanbadrig point, which may be readily known by the church standing near it, the coast trends east about one mile to Llanlana head, the northern extremity of Anglesea. The head is steep-to, with a small opening between high rocks, named Llanlana cove, close westward of it.

Porth Gynfor.—From the head, the coast trends south-eastward for one-third of a mile to Porth Gynfor, a small cove at the mouth of a ravine, similiar to that of Llanlana. The gusts out of the ravine at Porth Gynfor, during a southerly gale, are very severe.

Porth Wen.—From Porth Gynfor the coast, bold and rocky, extends eastward two-thirds of a mile to Porth Wen, a small cove bounded by sloping rocky ledges. Except for a limited extent within the western head, cliffs 40 feet high skirt the bay, which is about one-quarter mile wide and deep. A smooth shingle beach in the opening within the western head affords facility for beaching a small craft in case of extremity; should such occur, it is necessary to pass on the starboard hand of an outlying arched rock.

BULL BAY.—The coast, still of the same bold, rocky character, trends east-south-eastward one mile from the eastern point of Porth Wen to Melyn head, the north-west extreme of Bull bay. Bull bay is one mile across, half a mile in depth, and bounded by rocky cliffs. The shelter afforded, in 5 or 6 fathoms over sand, is good in off-shore winds, from W.N.W. to S.E. The tidal stream in this bay attains a rate of only 2 knots, while the stream in the offing is running nearly 5 knots.

Immediately within Melyn head is Porth Llechog, a boat cove and watering-place, but the rocks which form it shelve off fully one cable, and are topped by a high and dangerous swell in easterly winds.

Lifeboat.—A lifeboat is stationed in Bull bay.

EAST MOUSE lies about 2 cables off the east point of Bull bay; it is 70 yards in length by 30 yards in breadth, 12 feet high, and steep-to. The channel between it and the main is 7 fathoms deep, but in navigating it coasters keep near the islet in order to avoid the ledges which skirt the point abreast.

Lynus point light in sight leads northward of the East Mouse.

AMLWCH BAY lies immediately eastward of Bull bay and the East Mouse, and is nearly half a mile wide at its entrance, but it rapidly narrows towards its head, where is the tidal harbour.

A short distance off the west side of the bay is a rock with 9 feet water; its position is indicated by two beacons near Mona mill on the western side, and by two other beacons on the south side of the bay.

Amlwch harbour, at the head of the bay, has a depth at the pier-head of 18 feet at high-water springs, and 13 feet at neaps, but it is dry at low-water springs. During strong on-shore winds vessels cannot enter.

The harbour is formed by a well-built stone pier projecting from the eastern cliff, within which is a tidal-basin protected from the in-run of the sea by booms. This basin is capable of holding a number of small coasting craft, and was constructed for the shipment of the copper ore obtained from Paris mountain, and other mines in the neighbourhood. It has a hard and flat bottom, but vessels lie securely in it.

Light.—Signals.—A *fixed white* light is shown from a small white lighthouse on the pier-head at an elevation of 36 feet above high-water, visible between the entrance points only. It is not lit during strong on-shore winds, when the harbour is closed by the booms; at such times, or when a *red* light is shown, no vessel should attempt to enter. A ball hoisted on a staff at Llam-y-carw point, the east point of the bay, gives the like warning by day.

Tides.—It is high-water, full and change, at Amlwch, at 10h. 30m. local, 10h. 47m. Greenwich time; springs rise about 18 feet, neaps about 13 feet.

Pilots are always in attendance at tide-time to assist in warping vessels into the harbour.

Directions.—Amlwch may be easily distinguished from seaward by Mona mill, a conspicuous object over the west side of the harbour, and also by the flame and smoke of its furnaces. Mount Paris, 484 feet in height, with a beacon post surmounted by a bell top, at $1\frac{1}{2}$ miles southward of Amlwch, is also conspicuous.

No directions are necessary beyond avoiding the rock on the west side of the bay.

At night, Lynus point light becomes obscured when a vessel is within half a mile northward of the entrance; the pier light, showing *white*, should be brought to bear about S.W. by W. and steered for, which leads in the fairway. As the approach is very contracted, and in off-shore winds the bay is very subject to variable gusts, a sailing craft should have an anchor ready for letting go, and warps pointed.

Coastguard.—Rocket station.—At the coastguard station, on the west side, is a rocket apparatus, with belts and lines.

Graving dock.—At the head of the harbour is a graving dock, 131 feet in length by 24 feet width in entrance, and a depth of 11 feet at high-water springs, for the repair of vessels not exceeding 200 tons.

Amlwch is a creek of Beaumaris. Besides the export of copper there is a considerable manufacture of alkali, colour and paint; coal

and sulphur are imported. The aggregate value is about £9,500. The railway from Amlwch passes through the centre of Anglesea, joining the Holyhead and Chester line at Gaerwen station.

Population in 1881, 2,664. About 100 coasting craft enter annually of the aggregate tonnage of 5,000 tons. Coal and other small supplies are obtainable for the coasting trade.

LYNUS BANK, about half a mile off the coast between Amlwch and point Lynus, is about half a mile in length, in a direction parallel to the coast, by one cable in breadth, with a least depth of 6 fathoms, and steep-to; it is generally marked by an overfall. At its centre, the East Mouse is in line with the middle of porth Llechog, and Llanelian church is open twice its apparent breadth to the westward of the beacon on Llanelian mountain.

LYNUS POINT, situated $1\frac{1}{2}$ miles eastward of Amlwch bay, is, from its character and advanced position, very conspicuous from the eastward and westward. On the north-east brow of Llanelian mountain, within Lynus point, is a disused telegraph station.

LIGHT.—From Lynus lighthouse, a white castellated building, 36 feet high, standing near the extreme of the point, is exhibited, at an elevation of 128 feet above high water, an *occulting white* light, which continues visible for *eight seconds*, and is then obscured for *two seconds*, and may be seen at a distance of 16 miles in clear weather. The light is masked inshore of the bearing S.E. $\frac{2}{3}$ E. to lead northward of all dangers between it and the Skerries; and also inshore of a N.N.W. bearing to lead eastward of Dulas rocks.

Telegraph station.—There is a telegraph station in connection with Liverpool at Lynus lighthouse. Vessels signalling to the station will be answered from the flagstaff on the east side of the lighthouse.

Pilot vessels.—Some of the Liverpool pilot-vessels cruise in the neighbourhood of Lynus point; they are furnished with signals for communicating with the various coast telegraphs in connection with Liverpool.

Tidal streams.—The stream turns off Lynus point at the time of high and low-water by the shore, or half an hour before it turns at the entrance to Liverpool. At an offing of one mile the stream runs at the rate of 5 miles per hour at springs, and at 3 miles per hour at neap tides. The spring flood produces a strong race for the distance of half a mile eastward of the point.

Lynus cove, on the west side of Lynus point, is one-third of a mile deep, and a secure anchorage in off-shore winds, the depths

being 8 to 9 fathoms, over mud and sand, within the stream of tide. No coaster should be caught here with the wind in, for the shores are steep and a sea is quickly sent home. Caught under such circumstances, the only chance of saving life would be by beaching under the shelter of the rocky spit at the head of the bay, passing eastward of the spit, and then hauling towards the limekiln on the west side of the head of the cove.

Good fresh water may be procured at the landing-place.

FRESHWATER BAY, half a mile southward of Lynus point, affords anchorage, during westerly gales, in 9 to 10 fathoms. In a small creek in this bay, used by fishermen, landing can be effected when it would be impracticable at Lynus cove. Fresh water may also be procured in a ravine at the south end of the bay.

Porth Helygon, under the slope of Llanelian mountain, half a mile southward of Freshwater bay, also affords shelter in westerly gales, in 4 to 5 fathoms, over sand; the high-water line is shingle, but the ledges, dry at low-water, which project from it, render landing difficult at that time. Near the limekiln, abreast the middle of the bay, fresh water may be procured.

DULAS BAY, situated $2\frac{1}{2}$ miles southward of Lynus point light, receives a little protection at low water, with the wind westward of North, from the Dulas rocks and the shallow flat between them and the shore; but it is only suitable for a temporary anchorage for small craft in off-shore winds.

Dulas rocks.—Beacon.—Dulas rocks, about 4 cables in extent, parallel to the coast, with its centre only uncovered at high water, lies half a mile from the coast on the north side of Dulas bay. A beacon tower, with staff and vane, 31 feet above high water, stands in the centre of the group. A detached patch one cable seaward of the beacon, dries at low water; a short distance beyond it is steep-to.

At night, point Lynus light kept well in sight leads outside the rocks, but the extreme limit of the light leads in about 3 fathoms. Those locally acquainted occasionally use the 2-fathom channel between the rocks, keeping Lynus point lighthouse just in over Helygon point.

Traeth Dulas.—From porth Helygon the coast trends for half a mile southward to a copper mine near the high-water line; thence south-westward to the entrance of Traeth Dulas, an inlet with an entrance only one cable wide, but one mile in extent within by 3 cables in breadth. The southern point of the entrance consists of a shingle beach and low flat sand-hills. Traeth Dulas is

available for flats and other small craft at high-water springs, but the foreshore dries one-third of a mile beyond the entrance at low water.

MOELFRE ISLET and ROAD.—Moelfre islet, separated from Moelfre point by a narrow rocky channel, forms the south point of Dulas bay. The village of Moelfre, on the margin of Moelfre bay, has a shingle bank in front of it. At this place good water and other supplies may be procured; quantities of fish are also caught by the fishermen, and sent to Beaumaris and neighbouring markets. The *Royal Charter* was wrecked here in October 1859, when nearly the whole of the crew and passengers were drowned.

Moelfre road is often used by light draught vessels from Liverpool in westerly gales, in preference to bearing up for the Mersey. The shelter is complete with the wind from between N.N.W., through west, to S.S.W., in depths of 3 to 4 fathoms, over a bottom of mud and sand, with but little stream of tide. It has also the advantage of the near neighbourhood of Menai strait to afford shelter in case of extremity.

Coastguard.—Lifeboat.—Moelfre is a coastguard and lifeboat station.

Traeth Bach is a well-marked bight, one-quarter of a mile wide, close southward of Moelfre road; it is dry at low water, but coasters lie upon its clean sandy beach, and ship large quantities of limestone from the quarries near it.

RED WHARF BAY* is $2\frac{1}{2}$ miles wide between its entrance points, out to which it dries at low-water springs, or nearly $1\frac{1}{2}$ miles from its head, beyond which it gradually shelves to depths of 3 to 4 fathoms, over sand and mud.

Red Wharf bay is situated so much within the general line of coast that sailing vessels using it cannot be too cautious in guarding against a change of wind from off-shore; when that occurs, no time should be lost in seeking the shelter of Menai strait. Through the deep ravine also which extends nearly across Anglesea and has its outlet by Llwydiart mountain at the head of the bay, violent gusts proceed in westerly gales; they are sufficient to dismast small craft near the coast incautiously carrying much sail.

Carreg Dwrban, or Castle point, the western boundary of Red Wharf bay, is crowned by a steep, abrupt, and regular mass of rock, not unlike the remains of a castle when seen from a distance. At the point the coast turns abruptly to the south-westward for upwards of one mile to the head of the bay; thence, as a ridge of low sand-hills, sweeps gradually round to abreast Llandonna church.

* See plan of Menai strait, No. 1,464.

A large quantity of limestone is shipped from a jetty at Porth Llongdy, two-thirds of a mile within Castle point.

TABLE ROAD.—The cliff of Carreg Onnen, the east extreme of Red Wharf bay, has just within its brink a building like an old tower. From thence the coast, a limestone cliff, trends irregularly eastward for $2\frac{1}{2}$ miles to Dinmor point, forming the south side of Table road, with small shipping-places that are used by small coasting craft in off-shore winds. It is steep-to under Table hill.

Table road has depths of 6 to 7 fathoms, sand, and affords anchorage in off-shore winds. The tidal streams in the road run at the rate of 3 knots at springs, and $1\frac{1}{2}$ knots at neaps.

Dinmor bank, with a least depth of 11 feet, is the north-west extreme of the foul ground extending half a mile N.W. by N. from Menai lighthouse, and forming the west side of north-west entrance to Menai strait.

A red can buoy (local), $1\frac{1}{2}$ cables within the extreme of the bank, marks the south side of a narrow swashway of about $3\frac{1}{2}$ fathoms. The inner fall of Great Orme head open of Puffin island leads northward of Dinmor bank, and southward of Ten Feet bank; and Penmaen Mawr peak in line with Puffin beacon (the north-west channel mark) leads eastward of it.

Ten Feet bank, eastward of Table road, and in the north-west approach to Menai strait is, within a depth of 3 fathoms, one-third of a mile in length, with a least depth of 9 feet near its west extreme, from which the semaphore ruin on north-east end of Puffin island bears S.E. $\frac{1}{2}$ E., distant $8\frac{1}{2}$ cables. Porth Llongdy house open of Carreg Onnen, bearing W. $\frac{1}{2}$ N., leads northward of it.

The sea breaks heavily over the bank during north-west winds with the ebb tide.

Buoy.—A spherical buoy, painted in black and white horizontal stripes, in $3\frac{1}{2}$ fathoms, is placed one-quarter of a mile W.N.W. of the 9-feet patch.

MENAI STRAIT. *Continued from p. 282.*

NORTH-EAST ENTRANCE.—General Remarks.—The north-east entrance to Menai strait lies between the east coast of Anglesea and the coast of Carnarvon; but the navigable channel is confined to the Anglesea side, eastward of which are the Lavan and Dutchman sands, which encumber the south-west portion of Beaumaris bay.

The entrance to the strait is divided by Puffin island into two channels—namely, north-west entrance, with a depth of 9 feet at low-water springs, 26 feet at high-water neaps, and 32 feet at high-water springs; and north-east entrance, with a depth of 15 feet at low-water springs, 31 feet at high-water neaps, and 38 feet at high-water springs. It is however only used by small vessels, as stated in detail on pp. 275, 312.

Puffin island, or Priestholm, distant about 4 cables from Trwyn Du, the north-western point of Menai strait, is rather more than half a mile in length by 300 yards in breadth; it has near its centre the conspicuous tower of a ruined chapel, and at its north-eastern extremity one of the old telegraph stations and attached buildings. The ledge, or rocky base of the island, does not project off more than half a cable, except at its south-western end, from whence a mass of rock extends about one-quarter of a mile.

The landing-place is just within the south-west extremity of the island, and may generally be used except in strong south-easterly winds.

Beacon.—The western elbow of the south-west ledge of Puffin island, which covers at 13 feet rise, is marked by a large conical stone beacon, striped horizontally black and white, with a staff and globe on its summit.

A long narrow spit, known as the Causeway, extends S.S.E. one-quarter of a mile from the beacon; it is composed of large stones, dries about 2 feet at low water, with a depth of one fathom close-to.

Buoy.—The southern extremity of the Causeway is marked by a red conical buoy with staff and globe.

TRWYN DU, or BLACK POINT, is the north-western boundary of the entrance to Menai strait; the neat stone residences of the light-keepers are prominent objects upon it.

MENAI LIGHT.—From the extreme of the rocky ledge, extending about 200 yards north-eastward of Trwyn Du, is exhibited, from a circular stone castellated lighthouse, painted in black and white horizontal bands, and 96 feet high, a *fixed red* light, at an elevation of 61 feet above high-water, visible from a distance of 12 miles in clear weather, except where obscured by Puffin island. A causeway connects the light with the shore, covered in places at high water, and a rock with less than 6 feet lies about 30 yards seaward of the light.

Fog signal.—A bell is sounded in thick or foggy weather *three times* in quick succession *every fifteen seconds*.

Penmon bay.—From Trwyn Du, the coast trends south-westward for one-third of a mile to Penmon point, close round which, in Penmon bay, is a limestone quarry and shipping-place. The bay dries throughout to the distance of 4 cables from its head, but there is a depth of 14 feet at the small pier at high-water springs, and 8 feet at high-water neaps. Lifeboat, *see* p. 311.

Carreg Duon.—Southward of Penmon bay is a bight, which dries out 4 cables from the bridge at its head, and from one to half a cable off Penrhyn and Trecastell points, which contain it; this foreshore is composed of stones and rocks, many of which stand up 5 or 6 feet above the general level, and are therefore dangerous to small craft. The channel abreast Carreg Duon, its outer point, is contracted at low water to a breadth of one-third of a mile.

Friar's bay.—The bight between Trecastell point and Beaumaris is named Friar's bay. Friar's house, a large mansion, stands among trees near the shore abreast the middle of it. From this house, southward, the high-water boundry is a cliff, which, at Battery hill, attains the elevation of 65 feet. On the point of Beaumaris green, the customs watch-house stands conspicuously forward, and is useful as a sea-mark. The foreshore dries to about one cable outside the point, and the channel becomes tortuous and little more than one cable wide.

BEAUMARIS.—The town of Beaumaris occupies about half a mile of the shore frontage, the portion facing the water consisting of handsome mansions and terraces of houses. Beaumaris castle, an ivy-clad ruin, is at the east end of the town. The square tower of the church is a conspicuous object, and Baron hill, a baronial residence in the midst of wood, is prominent a little above the town, and being backed by hills with a well-marked outline, completes a picture of great beauty.

A landing-pier extends 200 yards from the middle of the town face to low-water mark, with a depth alongside of 15 feet at high-water springs, and 8 feet at high-water neaps.

LIGHT.—On the head of the pier, a *fixed red* light is shown throughout the night.

Beaumaris has no manufactures and but little trade. It is, however, the chief port of the custom-house for Bangor and neighbouring creeks. About 300 vessels enter Bangor and port Penrhyn annually, amounting to the aggregate tonnage of 64,000 tons. There is also

a considerable coasting trade, consisting almost entirely of slates for which no clearances are required. Population of Beaumaris in 1881, 2,241.

Gallows point.—Between Beaumaris and Gallows point the coast is low and flat ; the low-water shore, consisting of mud and sand, is well adapted for vessels lying aground. A red can buoy a little southward of Gallows point, marks the extreme of the low water, 2 cables from the high line, also the narrowest part of the low-water channel, which is less than one cable wide.

Coast.—Ferries.—From Gallows point the shore trends westerly for one mile to a point and ferry abreast Garth. This point is steep-to, and half a mile from Bangor point, or Trwyn-y-Garth, the opposite point of the ferry. At low-water the channel is only two cables in breadth.

A description of the channel above Garth point would serve no practical purpose, as a vessel passing along it would be in charge of a pilot ; it will be sufficient to observe that for 2 miles farther, to the suspension bridge, it is bordered by rich woods and numerous villas, and by a stony foreshore averaging one cable in width. The continuity of the shore for the last mile, however, is broken by four islets based on a ledge of rocks conforming to the general direction of the strait. A little above the south-westernmost islet is a landing-quay and stage, and a short distance farther is the old ferry slip in connection with a landing-place under Bangor ferry-house on the opposite side. It is still used as a convenient passage, the distance across being one-fifth of a mile. A danger, named the Half-tide rock, lying about 30 yards from the shore, with a depth of 2 fathoms within it, lies nearly midway between the old ferry and the suspension bridge.

Bridges.—The suspension bridge, and the Britannia tubular bridge, one mile above it, are structures too well known to need much description here. The suspension bridge is 916 feet in total length, with central navigable span of 560 feet, and the roadway is 100 feet above high-water ; the Britannia bridge has a navigable channel on either side of the central tower of 370 feet in width, and the roadway is 101 feet above high-water. The former was opened in 1826, the latter in 1850.

EAST COAST OF THE STRAIT.—Penmaen mawr point, on the south-eastern side of Menai strait, lies about 4 miles southward of Puffin island. This rocky point is the foot of the remarkable mountain of the same name, the summit of which is 1,540 feet above

high-water. The mountain stands boldly forward from the range on either side of it, its dark colour, being varied by the working of extensive quarries in its face, and it forms a striking object, even at a considerable distance seaward. The village is a summer resort.

Penrhyn castle.—From Penmaen mawr, the coast, as a low foot to a mountainous back-ground, extends westward 5 miles to the river Ogwen, and to the projecting point of Penrhyn; within the latter the ground rises into a prominent hill, on which is the well-wooded and beautiful park of Penrhyn, with its castle, the picturesque towers of which are seen from every part of the strait. From the bath-house on the extremity of Penrhyn point, the shore to Garth ferry forms a bay one mile wide and a quarter of a mile deep, in which is Penrhyn quay and basin.

PORT PENRHYN, close eastward of the city of Bangor, is a dry harbour, having depths of 11 to 13 feet at high-water springs. At its east side are the two wharves, with a tidal basin between them about 400 yards in length, with depths of 13 to 17 feet along-side at high-water springs, and 7 to 11 feet at high-water neaps. It is situated 5 miles within the north-east entrance to Menai strait. Vessels will find good anchorage in Friar's road or Bangor pool, until the tide suits for entering the port; these anchorages may be reached at all states of the tide by the class of vessels that frequent the port. Vessels over 11 feet draught sometimes load with slate during neaps, in Bangor pool.

LIGHTS.—A *fixed green* light is exhibited from the east pier head, and a *fixed red* light from the west pier head; *white* lights are placed at intervals along the wharves, which can be seen by vessels navigating the strait.

Ferry pier.—From Bangor point a sloping iron ferry pier extends to just beyond low water; it has a depth of 14 feet over its extreme at high-water springs, marked by a black buoy just beyond it.

BANGOR.—The city of Bangor stands low in the valley within Bangor point. Upon the summit of the northern ridge of the valley is Camp hill, 201 feet in height, an important sea-mark.

The chief trade of Bangor is in slates, which are exported in vast quantities, employing at the chief place of quarrying, distant about 6 miles, about 6,000 men; ship-building is also carried on to some extent. The population in 1881 was 8,240. The railway from Chester to Holyhead skirts the shore below Penmaen mawr, and crosses the strait by the Britannia bridge, while a branch line is continued on to Carnarvon. For Custom house, *see* p. 307.

H.M.S. *Clio*, a training ship for boys, is moored in Bangor pool.

Patent slip.—There is a patent slip on which vessels of 300 tons can be taken up, with a depth of 14 feet at high-water springs.

Coastguard.—Bangor is a coastguard station.

From Bangor point the coast trends nearly direct to the suspension bridge, and its stony low-water shore becomes gradually reduced to less than half a cable.

SAND BANKS.—Bangor flats.—The extensive sands in front of Penrhyn, known as Bangor flats, dry out nearly one mile abreast Bath point, and to a quarter of a mile abreast the ferry; they are partly occupied by salmon weirs and by a large bank of ballast discharged by the vessels which load at port Penrhyn. The west side of the flat, a little northward of Bangor ferry, is marked by a black nun buoy.

Lavan sands, Dutchman bank.—The north-east entrance of Menai strait, between Trwyn Du and Penmaen mawr points, is 4 miles wide, nearly the whole of which space up to Bangor is occupied by the Lavan sands, Dutchman bank, and Irishman spit, all dry at low water. Penmaen swash and the Pool separate Lavan sands and Dutchman bank, and Midlake swash separates Dutchman bank from Irishman spit; the north extreme of the shallow water beyond is known as Dutchman spit, beyond which the water deepens suddenly to 8 to 10 fathoms.

The whole of Lavan and Bangor flats are composed of fine sand, but the foreshores of the strait from Penmon point to the suspension bridge on the one side, and from Bangor point to the bridge on the other, consist of large and small stones and rocky patches.

Friar's bank, 3 cables in length, with from 7 to 12 feet water, lies in the fairway abreast Battery hill, Beaumaris; the depth in the fairway, on either side of it, is about 15 feet.

Buoys.—Black can buoys mark the port side of the channel on entering, and red conical buoys the starboard hand, lettered and numbered from seaward, *see* chart. The black and white chequered can buoy with perch, marking the south extreme of the causeway, extending southward of Puffin island, must, however, be left on the starboard hand, if entering by north-east entrance. As these buoys are subject to alteration by the local authorities, no dependence must be placed in the positions shown on the charts.

Pilots.—Menai pilots reside at Penmon, just within the entrance, and are always on the watch, but having only small boats they are often unable to board vessels when their services are most in request,

and do not get on board until the vessel is within the entrance and comparatively out of danger.

Three pilots are required for proceeding right through Menai strait, namely, one for Beaumaris, one for the Swellies, and the third for Carnarvon.

Lifeboat.—The pilots form the crew of the Penmon lifeboat, which is stationed just within Menai lighthouse dwellings.

DIRECTIONS to Outer road.—The two entrances into Menai strait which are separated by Puffin island, have each their advantages under different circumstances of wind and weather; thus the north-west entrance, or “the sound” as it is sometimes called, may, from its direction, depth, and well-marked character, be taken in the heaviest gale when refuge is required, provided dependence can be placed on the steerage of the vessel; while in south-easterly winds the north-east entrance is generally used by sailing vessels, as the wind is then foul in the north-west entrance, which is too narrow to beat through.

It is necessary to remember that the flood stream begins to set through the north-west entrance when it is low-water by the shore, or three-quarters of an hour before the turn of the stream off Liverpool; at the north-east entrance the stream begins $1\frac{1}{2}$ hours later.

North-west entrance, has a least depth in the fairway of 3 fathoms, over a breadth of 150 yards, rocky bottom, but it is $1\frac{1}{2}$ cables wide between the low water features. Within this narrow portion, the water deepens abreast the Causeway to 14 fathoms, in the pool, thence gradually decreasing to 5 and 4 fathoms in the Outer road, which is about one-third of a mile in length by 2 cables in width.

To enter.—The general leading mark from seaward, through the north-west passage, between Ten Feet and Dinmore banks, until well up to Puffin island beacon, is Penmaen Mawr, in line with Puffin island beacon, bearing S.S.E. $\frac{1}{4}$ E.

From the westward, along shore, keep the inner fall of Great Orme head, open northward of Puffin island, which leads northward of Dinmore bank, until the above mark comes on.

Having arrived abreast the lighthouse, with Penrhyn castle just opening, steer about South, passing midway between the beacon and Trwyn Du; from abreast the Causeway buoy steer S.W. into Outer road, and anchor in $3\frac{1}{2}$ to 4 fathoms, sand, with Penmon church bearing N.W. by W. $\frac{1}{2}$ W., or just open southward of Penmon point; and

Camp hill, near Bangor, open a little north-westward of Beaumaris watch-house. In this roadstead the weight of the sea in north-easterly gales is so broken by the outer banks that there is no difficulty in riding in it, to a vessel well found in ground tackle.

North-east entrance.—The north-east entrance, which should not be taken much before half-flood, except by very small craft, has 9 feet least water on the central rocky ridge, abreast the north-east end of Puffin island, and 20 feet at half-flood. Within this ridge, the channel for one-third of a mile is about 2 cables wide, when it becomes gradually contracted for a short distance, to half that breadth by a spit projecting from the Causeway with 4 feet upon it, to the distance of one cable southward of the buoy, forming an obstruction to this portion of the navigation; southward of this spit is Outer road.

To enter.—Steer in with the old tower on Anglesea in line with Penmon point, W. by S. $\frac{3}{4}$ S., which will lead up to the north-east entrance, northward of Dutchman spit can black buoy. Thence the leading mark is Camp hill, near Bangor, in line with Beaumaris watch-house, bearing S.W. by W. until Menai lighthouse is in line with Puffin island ledge beacon; then steer S.W. $\frac{1}{2}$ S., to pass one cable south-eastward of the chequered beacon buoy at the end of the Causeway; and when Penmon church opens of Penmon point, steer for it, and anchor in the Outer road as before directed.

Above Outer road.—To proceed above Outer road, keep Camp hill a little open of Beaumaris watch-house point, passing between the black buoys on the port hand, and red buoys on the starboard hand until the end of Friar's lane (close to the southward of Friar's house) appears in line with Baron hill, W. by S. $\frac{1}{4}$ S.; when steer for it, until Penmon church is in line with the outer end of the weir near Carreg Duon, N.E. $\frac{3}{4}$ N.; this latter mark astern will lead up to Friar's road, where anchorage may be taken if necessary with the old tower above Baron hill nearly in line with Friar's house, in about 4 fathoms, mud and sand.

Vessels drawing about 8 or 9 feet may work up to Friar's road at low-water, but care must be observed while standing towards the Anglesea shore, when southward of Carreg Duon, to keep the west end of Puffin island open of Penmon point, and to tack off the Lavan sands side by the lead.

Friar's bank divides the channel above Friar's road into two passages, having depths of about $2\frac{1}{2}$ fathoms at low-water. The wider channel is eastward of the bank and the leading mark astern is Penmon

church open eastward of the end of the weir near Carreg Duon, bearing N.E. $\frac{3}{4}$ N. passing close westward of the black can buoy, No. 5, on Lavan sands, until Baron hill is in line with the watch-house, when the vessel will be about one cable outside of the red buoy marking the foreshore from the point. In this position is good anchorage in 5 or 6 fathoms for wind-bound vessels, but the stream is strong and it is subject to eddies.

If intending to anchor abreast Beaumaris, then steer in mid-channel towards the white house within Gallows point, passing to the northward of the black can buoy, No. 6, at the end of a spit from the Lavan, and anchor in the road rather on the town side of the channel in 4 or 5 fathoms, clay, with Baron hill in line with the church. There is always some swell in this road with fresh northerly winds.

To proceed up to Bangor pool, steer from Beaumaris road towards Camp hill, taking care to leave the red conical buoy, M. 1, marking the elbow of the oyster bed off Gallows point, half a cable on the starboard hand; having rounded it, steer for the Toll-gate house, on the western shore, passing northward of an eight-foot ridge lying rather over on the south side of the channel. Give the Toll-gate point a berth of one cable, and anchor in Bangor pool, (which is immediately above it,) when the highest tower of Penrhyn castle appears in line with Bangor or Garth point, in 5 to 7 fathoms, mud and sand. This is a convenient stopping-place for vessels not adapted for taking the ground, and it is usual for large vessels loading slates to anchor in it and receive their cargoes from flats, as port Penhryn will only accommodate vessels of 11 feet draft at high-water neap tides.

Reference has already been made, at pp. 281, 282, to the confined and critical navigation of Swellies reach between the suspension and tubular bridges, and as no vessel should use the passage without a pilot, any directions for its navigation are unnecessary.

BEAUMARIS BAY,* about 5 miles wide by 4 miles deep, embraces the whole of the space within the line of Puffin island and Great Orme head, and no stranger should tarry within that line except under favourable circumstances. With a strong northerly wind and flood tide a sailing vessel would have little chance of beating out of it, and, instead of allowing her in such a case to be forced into the bay, the seamen should be prompt in seeking the shelter of Menai strait. The bay outside the line of the sands is free of hidden dangers for vessels of 18 feet draught, and the bottom throughout is regular with fair holding ground.

* See Admiralty chart :—Holyhead to Liverpool, No. 1,170a.

Off the south shore of Beaumaris bay, depths of 3 fathoms, and less, extend a distance of $1\frac{1}{2}$ miles.

Llys Elis ap Clynnog, a patch of rocks dry at low-water, lie about three-quarters of a mile off shore abreast Dwygyfylchi, but within the one-fathom line.

Four-fathom bank.—From the Great Orme, the east point of Beaumaris bay, a bank with less than 5 fathoms extends about $3\frac{1}{2}$ miles to the westward, and named the Four-fathom bank; a portion of it, about half a mile in extent, has a depth of $3\frac{1}{2}$ fathoms only, from the centre of which the North Toe of Great Orme bears S.E. by $\frac{3}{4}$ E., distant $3\frac{3}{4}$ miles. A smaller patch, with 4 fathoms least water, lies one mile S.W. by S. of the depths of $3\frac{1}{2}$ fathoms, with 5 to 6 fathoms between them.

Coast.—From Penmaen mawr point the shore of Beaumaris bay sweeps to the eastward for 3 miles to Penmaen Bach point, which, though not so bold and majestic, somewhat resembles the former point (*see sketch on chart*).

From Penmaen Bach point to Mussel hill, the point of Conway marsh, and the western boundary of the entrance to the river Conway, the coast forms a rather deep bight. Mussel hill is of a dark colour and somewhat singular appearance, being an artificial mound, consisting of the refuse of mussel shells collected in former years for the purpose of obtaining pearls.

Diganwy point, at the opposite side of the entrance to the Conway, is very low, and fronted by a shingle beach 70 yards broad; then succeeds the marshy isthmus Morfa Rhianedd, which is in one part only half a mile in width and about 18 feet above high-water, giving to Great Orme head the appearance of an island when seen from a distance.

RIVER CONWAY, or CONWY, is available for vessels of 10 to 12 feet draught at high-water springs, to the town quays, where they lie aground at low-water, or anchor abreast in 2 to 3 fathoms. The entrance channel is narrow, and the sands are constantly shifting, rendering the services of a pilot necessary, except to those well acquainted with the river.

Vessels of 6 feet draught can enter at half flood.

At its entrance, between Diganwy point and Mussel hill, it is but $1\frac{1}{2}$ cables in width, and nearly dry at low-water springs; within the entrance it is half a mile wide. Both above and below the bridge for the distance of about $1\frac{1}{2}$ cables, there is a pool with depths of

2 to 4 fathoms, but beyond this distance the river is nearly dry at low-water springs.

The Conway has its source in the small lake, Llyn Conwy, in the mountainous district where the counties of Merioneth, Denbigh, and Carnarvon meet. Its course for the first $7\frac{1}{2}$ miles is about north-east for Pentre Veolas; then, with a short westerly bend, on to Bettys-y-coed, 6 miles, near to which it is joined from the south-west by the rivers Machno, Lledr, and Llugwy. From thence it flows nearly due north $3\frac{1}{2}$ miles to Llanryst, passing under a beautiful bridge constructed by Inigo Jones, and on to Conway, 12 miles; the total length of the river being about 29 miles.

The Conway near the castle is, like Menai strait, and for similar purposes, crossed by two bridges, suspension and tubular, the latter running close southward and parallel to the first and earlier structure. The roadway of the suspension bridge is 110 yards long to a rock, which was formerly an islet, but is now connected by a causeway 800 yards in length with the eastern bank. The roadway of the bridge has an elevation of 18 feet above high-water, which admits of the passage of small craft under it.

Conway, or Aberconway town, is situated upon the west bank of the river Conway rather more than one mile above its entrance. The town presents the most picturesque appearance, for it is still enclosed by its old and dilapidated walls and towers, and its massive castle stands at the south end upon a rock, the chains of the suspension bridge passing through its walls; a connection of ancient and modern structures affording an interesting contrast. A quay, dry at low water, as before mentioned, fronts the whole of the river face of the town.

Conway, a creek at Beaumaris, is 14 miles by rail from Bangor and 45 from Chester; on the opposite side of the river a branch line runs to Llandudno, and another up the valley of the river to Llanrwst and Bettys-y-coed.

The population in 1881 was 3,179.

CONWAY SANDS AND CHANNELS.—Conway sands occupy the entire south-eastern portion of Beaumaris bay, within a line drawn from Penmaenmawr point to the middle of the Great Orme; there are two swatchways or channels through the sands known as South and North deep, both of which are subject to constant change.

South deep, the western channel of the Conway, lies immediately northward of Penmaen Back point; it is available for vessels of 10 to 12 feet draught at high-water springs.

The fairway buoy, painted in red and white horizontal stripes, with staff and diamond, lies in $2\frac{1}{2}$ fathoms, with Penmaen Back point bearing S. by W., distant $1\frac{3}{10}$ miles ; within the fairway buoy the buoys are all conical and painted red, 6 in number, and, together with the perch on the edge of the bank extending from Mussel hill, are to be left on the starboard hand on entering.

North deep, situated midway between South deep and Great Orme head, also admits vessels of 10 to 12 feet draught at high-water springs. The fairway buoy, No. 1, black conical, with staff and globe, in 2 fathoms, lies with the west extreme of Great Orme, bearing N. by E. $\frac{1}{4}$ E., distant three-quarters of a mile. Nos. 2 and 4 buoys, are black conical, and to be left on starboard hand on entering ; No. 3 is a can buoy, black and white vertically striped, and therefore a port hand buoy, in accordance with the Trinity system.

Pilots.—There are no licensed pilots for the Conway ; men acquainted with the navigation may, however, at times be obtained, but only in moderate weather as their boats are small.

Tidal streams.—The flood stream runs into the Conway for $4\frac{1}{2}$ hours, turning when it is high-water by the shore. The ebb stream which runs down for $7\frac{1}{2}$ hours has a velocity of 5 knots at springs and 3 knots at neaps.

Directions.—The river should in no case be entered before half-flood, and then only by persons well acquainted with it.

Conical buoys are to be left on the starboard hand, and can buoys on the port. The South deep buoys are red, or parti-coloured ; the North deep are black, or parti-coloured. Having crossed the bar, of either channel, and arrived abreast the perch, at the junction of South and North deeps, steer a little outside Diganwy point, passing it about a cable off ; thence bring the eastern turret of Conway castle open of Boblondeb point, which mark will lead to the town, off which anchorage may be taken up in 2 to 3 fathoms, as soon as the archway, half-way along the quay, bears West. Coasters usually berth alongside the quays.

Vessels drawing 10 or 12 feet must be careful to keep in mid-channel, even at high-water, for the passage is very narrow.

GREAT ORME HEAD is one of the finest objects on the coast, and extremely useful as a sea mark. Its northern face is a steep limestone cliff bold-to, from whence the ridge or head extends south-easterly for $1\frac{1}{4}$ mile, the highest part being elevated 676 feet. At a height of 664 feet, and upon near the centre of the ridge of the head,

are the remains of one of the telegraph stations formerly used in connection with Holyhead and Liverpool.

LIGHT.—On the North Toe of Great Orme head, from a square gray stone lighthouse, is exhibited, at the height of 325 feet, a *fixed* light, visible in clear weather at the distance of 24 miles. The light shows *white* from E.S.E., through south, to W. $\frac{1}{2}$ S., and *red* from W. $\frac{1}{2}$ S. to W. $\frac{1}{8}$ N. The southern limit of the *white* light leads to the Bar light-vessel, entrance to Queen's channel, Liverpool, and the south limit of the *red* light leads close to the Constable buoy and the bell beacon of Horse channel.

Telegraph.—There is a telegraph station here, by which passing vessels can communicate by signal with Liverpool or elsewhere.

St. Tudno's church, the old church of Llandudno, a small building with a belfry, many hundreds of years old, stands a few hundreds yards within the cliff at three-quarters of a mile eastward of the lighthouse.

CHAPTER XI.

GREAT ORME HEAD TO FORMBY POINT.

VARIATION IN 1891.

Liverpool bay - - 19° 20' West.

ORME BAY, situated at the eastern foot of the Great Orme, lies between Pen Trwyn and Little Orme head, and is about 2 miles in width ; Pen Trwyn, and the coast half a mile south-east of it is a steep cliff ; the head of the bay, in which is the town of Llandudno, is flat, rising at its east extreme to the Little Orme head.

The west side of the bay is fronted by rocky ledges which dry out half the length of the pier, but farther eastward the high line is shingle, fronted by sand at low water. The bay is shallow for half a mile off shore, there being as little as 9 feet at 4 cables S.E. by E. $\frac{1}{2}$ E. of the head of the pier.

The bottom of the bay, being mostly shingle, is bad holding-ground ; but, as there is very little stream of flood or ebb within the line of the heads, coasters often remain in it for a tide in fine weather, anchoring on the western side of the bay.

LLANDUDNO.—The western corner of Orme bay, where a few years ago there was only the fishing village of Llandudno, is now occupied by long terraces of stone houses, commodious hotels, St. George's church, and other buildings, forming Llandudno town, which is much resorted to as a summer watering place. Population, 4,839.

It is connected by a branch line of $3\frac{1}{4}$ miles with the Chester and Holyhead railway at Conway, and pleasure steamers between Liverpool and Beaumaris call at the pier when weather permits.

Pier and lights.—At the foot of Great Orme, a promenade and landing pier, of iron, 416 yards in length, extends in a N.E. by E. direction, having at its outer end a depth of $10\frac{1}{2}$ feet at low-water spring tides. A *fixed green* light is shown all night at the pier head. A *red* light is exhibited under the *green* light when vessels cannot go alongside the pier ; a red flag by day answers the same purpose. There are also other lights on the pier, and occasionally electric lights during the summer season,

Lifeboat.—A lifeboat is stationed near the town.

Little Orme head, with its high background, somewhat resembles the Great Orme, though much smaller. From little Orme head, the coast trends south-eastward for $1\frac{1}{2}$ mile to Rhos point, which is low and flat, and fronted by loose stones out to the low-water margin. The dark-coloured square tower of Llandrillo-yn-Rhos church is on a rising ground rather more than half a mile within the point.

The coast between Little Orme and Rhos point is fronted by foul ground to the distance of half a mile.

Rhos or Colwyn bay lies between Rhos point and Tan Penmaen head, $2\frac{1}{2}$ miles apart; it is half a mile deep, with a high-water boundary of shingle fronted by sand; and the low-water shore, which dries out about 2 cables, has some large rocks and stones around the head. The anchorage is good with off-shore winds.

A high salmon weir extends one cable off the point.

Colwyn.—The village of Colwyn, with its church, lies towards the eastern end of the bay; the railway passes through it.

CONSTABLE BANK, in connection with the outermost of the sands encumbering the approach to the river Dee, has, on its north-west extremity, depths of $4\frac{1}{2}$ to 5 fathoms, bearing N.E. by E., distant 3 miles from Great Orme head lighthouse; thence the bank, which here is only 3 cables in breadth, extends E.S.E. for 8 miles, increasing to one mile in width, when it becomes merged in the Rhyl and Chester flats fronting the Dee.

The bank is composed of fine sand, and eastward of the meridian of Rhos point are several patches of $2\frac{1}{2}$ fathoms, the least depth found on the bank.

Buoy.—A spherical buoy, painted in black and white horizontal stripes, with staff and diamond, is moored in 3 fathoms, southward of a $2\frac{1}{2}$ -fathoms patch, with Great Orme light W. $\frac{1}{2}$ N. distant about $5\frac{1}{10}$ miles. The buoy lies just without the southern limit of the *red* sector of Great Orme light.

Penmaen Mawr, touching the south-east foot of the Great Orme, and over the west extreme of Llandudno town, bearing S.W. by W. $\frac{3}{4}$ W., leads one mile north-westward of the Constable buoy, and across the tongue of the bank in $3\frac{1}{2}$ fathoms at low-water springs. The southern limit of the *white* light from Great Orme crosses the tongue in about the same position.

COAST.—**Llandulas.**—On the summit of the high land, which rises gradually from Tan Penmaen head to 666 feet above high water,

is Llysfaen telegraph, one of the old telegraph stations for communicating with Liverpool. The coast from Tan Penmaen head trends south-eastward for $1\frac{1}{2}$ mile to the valley and village of Llandulas, from whence a stream issues, and is lost in the shingle fronting the shore; then the coast continues south-easterly for one mile, and joins the frontage of the western end of Rhyddlan marsh, where a base line of about 4 miles was measured for the purpose of the Ordnance trigonometrical survey.

Lifeboat.—A lifeboat is stationed at Llandulas.

Abergelé town and road.—The white square tower of Abergelé church stands half a mile back from the coast line at the west end of Rhyddlan marsh, and the flat and shallow bay fronting it is known as Abergelé road; but, as the depth in it is only from $1\frac{1}{2}$ to 2 fathoms, it is only adapted as a temporary anchorage in off-shore winds for small vessels pursuing an in-shore track. There are patches of 3 to 6 feet at the distance of $1\frac{1}{2}$ miles off shore in Abergelé road.

Gwyrzych castle, an extensive building surrounded by trees, is a conspicuous object upon the eastern face of the hill midway between Llandulas and Abergelé.

From the cottages of Pen-y-Sarn, at the west end of Rhyddlan marsh, the coast for 3 miles to the mouth of the river Clwyd, is flat, with a foreshore composed of shingle and sand, nearly half a mile wide at low water.

Ty-wyn church tower, $1\frac{1}{2}$ miles eastward of Abergelé, is a conspicuous object from seaward.

Lifeboat.—A lifeboat is stationed at Abergelé. Population in 1881 was 1,916.

RIVER CLWYD and RHYL.—Three-quarters of a mile westward of the town of Rhyl is the outlet of the united rivers Elwy and Clwyd; the Elwy is swelled by many streams falling from the high land about Moel Saesiog, elevated 1,533 feet, having a general course from the south-west; and the Clwyd winds for about 20 miles through the beautiful vale of that name, to the junction between St. Asaph and Rhyddlan, at about 4 miles from the outlet.

The entrance to the river is simply a depression in the sand banks, scoured by the water from the river, and is subject to change both in depth and direction. Perches mark the edges of the channel.

A small quay immediately within the western point of the river admits vessels of 13 feet draught alongside it at high-water springs; and two quays upon the eastern side, having a similar depth, are

chiefly used by passenger steamers. About 12 vessels, of the aggregate tonnage of 2,540 tons, enter the river annually.

The railway crosses the river a little above the pier, so that no vessel can pass up to Rhyddlan, a distance of about 2 miles, unless with lowered masts.

Rhyl flats.—Patches of 3 to 6 feet exist on the Rhyl flats, at nearly 2 miles off shore; the outer extreme of these flats, in about 5 fathoms, lies 4 miles off shore, eastward of which are the Chester flats.

Rhyl.—The town of Rhyl, a summer resort, stands three-quarters of a mile to the eastward of the Clwyd; its extensive terraces of superior houses, hotels, and other erections, make it a prominent object from the sea. The population of Rhyl, in 1881, was 6,034.

Pier.—Fronting the principal hotel, near the centre of the town, a promenade pier, dry at low water, projects about north for 750 yards; at the head there is a depth of 15 feet at high water springs, and 9 feet at neaps.

Light.—A *fixed white* light is shown at the pier-head all night.

Tides.—It is high water, full and change, at the entrance of the river Clwyd, at 10h. 37m. local, 10h. 51m. Greenwich time; abreast the jetty in the river, the rise is 15 feet on equinoctial springs, 13 feet on ordinary springs, and 7 feet at neaps.

Coastguard.—**Lifeboats.**—A tubular lifeboat is stationed on the west side of the river, and one of the ordinary description near Abergelé; there are also life-belts and lines at the coastguard station.

Coast, aspect.—From Rhyl, the coast eastward to Air point at the entrance to the Dee, a distance of 7 miles, is a low shingle beach, having a breadth of about half a mile, with a foreshore of fine sand at low water. The objects which principally attract attention are the heights above Gwaenysgor, 756 feet above the sea, on which is one of the old telegraph stations, and St. Elmo summer-house, 769 feet in height, just eastward of it; lower down, about one mile within Air point, on the eastern slope of the same ridge, is the mansion of Talacre.

Telegraph station.—On the seaward slope of St. Elmo's ridge, is Voelnant telegraph and signal station, surrounded by a white wall. Passing vessels can communicate by signal with Liverpool.

Lifeboat.—On the shore nearly abreast Talacre, and $1\frac{3}{4}$ miles westward of Air point, is the Talacre lifeboat, maintained by the Mersey Docks and Harbour Board.

RIVER DEE.*—General Remarks.—System of Buoyage.

—The principal channels through the extensive sands which encumber the mouth of the Dee are, the Welsh channel, entered over Chester bar, and Hilbre swash. These each have a depth of about 13 feet at low-water springs, 32 feet at high-water neaps, and 38 feet at high-water springs, with about the same depth to Mostyn deep, 9 miles above, where vessels may lie securely afloat in 6 to 8 fathoms at low water. There is a depth of about 14 feet at high-water springs to Connah's quay, about 12 miles by the channel above Mostyn, and craft of about 9 feet draught can reach Chester 9 miles farther with the same rise of tide.

The channel over Chester bar, and its continuation, the south channel of the Dee, buoyed by the Trinity House, has black conical buoys on the starboard side on entering, black parti-coloured can buoys on the port hand, and spherical buoys on middle grounds. The Hilbre swash, buoyed by the Mersey Dock and Harbour Board, has red conical buoys on the starboard hand, on entering, and black can buoys on the port hand as far as Hilbre island. Within Hilbre island, this north channel of the Dee is marked by the Trinity House, red being the principal colour in this channel.

Caution.—The channels of the Dee, being liable to great changes, more particularly within the entrance point, the buoyage has frequently to be re-arranged, and navigation is unsafe without the assistance of a pilot. (*See p. 329.*)

It is dangerous also to ground in the channels during the ebb, for the sand washes away so quickly that a vessel is liable to fall over on her beam ends.

The buoys marking the dangers to vessels navigating Liverpool bay will be specially described ; the positions of the others will be seen on the chart.

Lifeboats.—A lifeboat is kept in a shed at the north point of Hilbre islet, and another on the beach at Talacre, $1\frac{3}{4}$ miles westward of Air point, as before mentioned ; both lifeboats belong to the Mersey Docks and Harbour Board.

The **river Dee** flows from the lake of Bala, in Merionethshire, and is soon after joined from the northward by the Tryweryn and the Alwen, near the town of Corwen, 16 miles from the lake ; the river then takes an easterly course through Denbighshire by the vale of Llangollen, and from Trevor by numerous windings, first south-

* *See Admiralty charts :—Holyhead to Liverpool, No. 1170b, and Liverpool bay, No. 1951.*

eastward and then northward, for the city of Chester, which it skirts along the southern side. Soon afterwards, entering an artificial cut, the Dee discharges into a broad estuary at St. Mark, or Connah's quay, 9 miles below the city, and 84 miles from its outlet from the lake. The estuary of the Dee is about 12 miles in length, from the artificial cut near Connah's quay to its outlet between Air and Hilbre points, where it is $4\frac{1}{2}$ miles across.

Air point, the west point of entrance to the Dee, is low and sandy; close to the high-water line stands a circular disused light-tower, 65 feet high, painted with red and white horizontal bands.

Hilbre islets.—Beacons.—The Hilbre islets, three in number, are situated on the Lime Wharf flat, which extends $2\frac{1}{2}$ miles southward of Hilbre point, and dries to the distance of $1\frac{1}{4}$ miles off shore at low-water springs; it connects with the Great Salisbury at low water.

Hilbre islet is nearly one-third of a mile long, in a north and south direction, narrow, and 40 feet high. Low-water rocks extend one cable from its north extreme, and close out to the deep water of Hilbre swash; the islet therefore forms a useful mark for it.

The middle, or Little Hilbre, is about 300 yards in length and 40 feet in height.

The inner or southernmost islet is small and low, and but little more than a high part of the ledge on which it stands, but it is distinguished by a large wooden beacon, painted black, erected on it, named the Eye. There is also another wood-frame beacon, with topmark, painted black, named the Beach mark, situated on the sand one-quarter of a mile eastward of Hilbre, the northern islet.

Telegraph.—The Mersey Docks and Harbour Board has a signal and electric telegraph station on Hilbre islet, also a tide-gauge. There are two houses on the islet, besides several sheds.

DEE LIGHT-VESSEL, moored in 8 fathoms in the inner portion of the fairway of Welsh channel, E.N.E., distant one mile from the old light-tower on Air-point, exhibits, at 30 feet above the sea, *a flashing white light every ten seconds*, visible in clear weather from a distance of 10 miles.

Fog signal.—During thick or foggy weather a gong is sounded.

SAND BANKS in the approaches.—Nearly the whole of the wide estuary of the Dee and its approaches, is occupied by shifting sandbanks, which dry at low-water to the distance of $4\frac{1}{2}$ miles off shore in places, varying in height from a few feet to

22 feet ; the principal of these are the East and West Hoyle banks, the Chester flat and Middle patch ; as before stated the buoyage is altered to meet any changes that occur, and the outer ones only will be described, these being less subject to alteration.

CHESTER FLATS are a continuation of the flats fronting the coast from Little Orme head eastward, to the distance of about 4 miles off-shore. The Chester flats, including Middle patch, which extends some 3 miles westward of the main flat, is about 5 miles in length within a depth of 2 fathoms, and triangular in shape ; its eastern portion dries from one to 2 feet, in patches, at low-water springs. These flats are composed of sand, fine gravel, and shells, and divide the western entrance to the Dee into two channels, the northern, known as the Welsh channel (over Chester bar), and the southern, as Inner passage. The south-east extreme of Chester flats forms the north side of Inner passage, and is known as the Earwig.

Buoys.—Earwig bell buoy.—At $1\frac{1}{2}$ cables south-east of the south-east extreme of Chester flats, is the Earwig bell buoy, painted in black and white horizontal stripes, with staff and diamond, in 9 feet water, marking the fairway between Chester flat and the shallows extending half a mile off shore, with Talacre lifeboat house S.E. $\frac{1}{2}$ S. $1\frac{1}{10}$ miles.

North-west patch buoy ; black, conical, with staff and cross, is situated on north side of entrance to Inner passage, and three-quarters of a mile within the west extreme of the tail of the Middle patch of Chester flat, in about 10 feet water, with Rhyl pier light bearing South, distant $2\frac{8}{10}$ miles.

The east side of Chester flat is marked by conical black buoys, namely, the N.E. middle patch buoy, Elbow buoy, and S.E. middle patch buoy. Chester bar buoy is referred to with description of Chester bar, p. 327.

WEST HOYLE BANK, immediately fronting the estuary of the Dee, separates Chester bar channel from Helbre swash ; it is about 8 miles in length in an east and west direction, by about 3 miles in breadth, within a depth of 2 fathoms. Its eastern portion abreast Hilbre island dries 22 feet, and towards its west end it dries 13 feet, with narrow swashways in places ; several wrecks lie on the bank.

West Hoyle bank is steep along its inner or southern boundary, as well as to the eastward in Hilbre swashway ; but its western side shelves to Chester bar channel, and its northern part slopes off irregularly into deep water.

Buoys.—West Hoyle, a red and white vertically-striped buoy, with staff and cage, is placed on the north-west extreme of the five-fathoms edge of West Hoyle bank, with Grange monument in line with Little Hilbre islet; Rhyl pier light bearing S.S.W. $\frac{1}{2}$ W., distant 5 miles; Great Orme light in line with the Constable buoy W. $\frac{1}{2}$ N., and Horse fairway bell beacon bearing East.

Vessels should keep northward of the line joining the two last-mentioned buoys, and at night keep the Great Orme light in sight.

Chester bar buoy (p. 327), marking the west extreme of West Hoyle spit, and all the West Hoyle buoys within it, are can-shaped and parti-coloured, and therefore, by the Trinity system, port hand buoys when entering, for the positions of which see the chart; they are named South-west Hoyle, Hoyle spit, South Hoyle, and East Hoyle. The south-east extreme of the bank is marked by a spherical red and white horizontal striped buoy, named the Welshman Gut.

The eastern side of West Hoyle bank is marked by five conical red buoys (marked respectively from seaward H.E. 1 to H.E. 5), and are starboard hand buoys when entering the Dee by Hilbre swash.

EAST HOYLE BANK extends 4 miles northward of Hilbre point and islets, being a continuation of Lime wharf bank, and forms the eastern boundary of Hilbre swash. The summit of the bank, 3 miles off shore, dries 10 feet at low water springs.

Buoys.—A pillar buoy, painted black, with letters H.E. Fy on it, marks the north-west extreme of East Hoyle bank in about 5 fathoms, with Eye beacon open westward of the Beach mark, S. by E. $\frac{1}{2}$ E. Horse buoy No. 1, next eastward, distant one mile, and Horse fairway buoy North, one mile.

The north-east and east side of the bank is guarded by conical red buoys, marking also the west side of Horse channel; page 346. The west side of East Hoyle bank is marked by black can buoys, five in number, marked H.E. 1 to H.E. 5, the inner one being situated abreast Hilbre islet; these mark the eastern side of Hilbre swash.

SALISBURY BANKS, within West Hoyle bank, occupy a large portion of the middle of the estuary of the Dee, which at low-water is thus divided into two distinct channels, named the North and South. A swashway east and west, divides the Salisbury into two portions; the northern one is again divided by a swashway running north and south; the portion westward of this swash is known as Salisbury Middle, and the other as Great Salisbury.

The bank dries 19 feet at its eastern portion, and in many others from 6 to 12 feet.

Welshman gut is the channel between West Hoyle and the northern portions of the Salisbury, and has a depth of about 7 feet at low water.

Buoys.—The north side of Welshman gut is marked by the spherical red and white striped buoy, placed at the south-east extreme of West Hoyle bank, before mentioned.

Salisbury Middle buoy, spherical, painted in black and white horizontal stripes with staff and diamond, lies off the north side of Salisbury Middle bank, in about 3 fathoms. S.W. Salisbury, off the west side of Salisbury Middle, is black conical; the channel is between the buoy and the bank.

Salisbury swash, can, black and white chequered, marks the south-west side of Salisbury Middle, and north end of Mostyn deep. The buoys in the swashways through the Salisbury, and that southward of it, will be best understood by referring to the chart.

MOSTYN BANK comprises the whole of the south-western flat fore-shore of the Dee estuary, and is about one mile in breadth from Air point to $3\frac{1}{2}$ miles above it, where it becomes broader and takes the name of Holywell and Bagilt banks.

Buoys.—The edge of Mostyn bank from Air point to Mostyn, forming the west side of the South channel of the Dee, is marked at intervals by black conical buoys, namely the Air, S.E. Air, S.W. Salisbury, M 1 and M 2. The south channel terminates at low water about 4 miles above Mostyn in Greenfield gut; at this state of the tide the only communication with the North channel is by way of Welshman gut.

ENTRANCE CHANNELS. — CHESTER BAR and WELSH CHANNEL.—Chester bar, lying between Chester flats and West Hoyle bank, is about half a mile in length and the same in width, with depths of 13 to 15 feet at low water, on either side of an 11-foot patch in mid-channel. There is a least depth of 32 feet at high-water neaps on the bar, and 38 feet at high-water springs. Within the bar, the water deepens to $3\frac{1}{2}$ and 4 fathoms, to abreast South-east Middle Patch buoy when it is again reduced to 12 or 13 feet, to nearly abreast South Hoyle buoy at the west end of Welsh channel.

Welsh channel is about $3\frac{1}{2}$ miles in length, with a least breadth of half-a-mile, and depths of 6 to 12 fathoms over its central portion. The Dee light-vessel (p. 323) marks the fairway at its eastern end;

here it divides, the southern channel leading to Wild road and Mostyn deep; and the eastern, by Welshman gut, leading to Hilbre swash and North Dee channel.

Buoy.—A black and white chequered can buoy, with staff and cage, marks the 11-foot patch on the centre of Chester bar, nearly 2 cables distant from the 2-fathom west edge of West Hoyle spit, which edge it originally marked, as a port hand buoy; the pilots usually pass northward of it. The buoy lies with Rhyl pier light bearing S.W. $\frac{3}{4}$ S., distant $4\frac{1}{8}$ miles. Those on either side of the channel have been previously mentioned with the flats they guard.

Directions.—This channel being marked by the Trinity House, all starboard hand buoys are conical, and of one colour, namely, black; port hand buoys, can, parti-coloured black, whilst Middle Ground buoys are spherical with horizontal stripes; in crossing the bar by the following leading mark, Chester bar buoy is an exception to the rule; but the widest channel is the proper side or southward of it. These buoys are moved to meet any changes that may occur in the channels.

Approaching from either eastward or westward, keep Crosby lighthouse open northward of the Horse fairway bell beacon, until about one mile westward of West Hoyle buoy, when the leading mark for Chester bar, namely, Brynllysten house (in a clump of trees above Talacre house, not easily distinguished by a stranger, more especially during the early part of the day, when the land is frequently obscured by haze), a little open eastward of Talacre lifeboat house, bearing S.S.E. $\frac{3}{4}$ E., should be brought on; this mark will lead in northward of Chester bar buoy, and in the fairway nearly up to Hoyle spit buoy; thence westward of the buoy.

The same house well open westward of the lifeboat house leads westward of Chester bar buoy, and up to N.E. Middle patch buoy, and the correct side of the bar buoy, being chequered.

When southward of West Hoyle spit buoy, steer for the Dee light-vessel, bearing about E. by S. $\frac{1}{2}$ S. to abreast Air black buoy, thence into Wild road, or Mostyn deep, with black conical buoys on starboard hand. See Anchorages, p. 328. The tidal streams run from $1\frac{1}{2}$ to $2\frac{1}{2}$ knots over Chester bar and 2 to 3 knots through Welsh channel.

If proceeding through Welshman gut, from abreast Dee light-vessel, continue on about E. by S. $\frac{1}{2}$ S., northward of Salisbury Middle buoy, and southward of Welshman gut buoy.

INNER PASSAGE, between Chester and Rhyl flats, with a least depth of 9 feet over a breadth of $1\frac{1}{2}$ cables, is much used by coasting craft entering the Dee from the westward; it is easier to navigate than Chester bar, on account of the streams of both flood and ebb being slacker and setting fairly through it, and being nearer the coast, the marks are easier distinguished in hazy weather.

To enter, steer in about half a mile southward of North-west patch buoy, with Talacre lifeboat house, bearing S.E. by E. $\frac{1}{2}$ E. easterly, and in line with the shoulder of Heswall Church hill on the Cheshire coast (if not obscured by haze), until abreast South-east Middle buoy, when steer to pass close on either side of the Earwig bell buoy, thence into Welsh channel, between East Hoyle and Air buoys, and on to Wild road, &c., as directed, p. 327, for Welsh channel. The tidal streams run from $1\frac{1}{2}$ to $2\frac{1}{2}$ knots in Inner passage.

HILBRE SWASH, situated between West and East Hoyle banks, is 6 miles in length from its bar to abreast Eye beacon, by half-a-mile in breadth. The bar is about one mile in length and breadth, with a least depth of 9 feet; equal to 28 feet at high-water neaps, and 34 feet at high-water springs, or about 4 feet less than the Chester bar. Within the bar the water deepens to 6 to 9 fathoms, up to Eye beacon; thence the water is shallow and the navigation intricate. The deepest channel to Mostyn deep is through Welshman gut, in about the same depths as over the bar.

To enter, steer in with the Eye beacon well open westward of the Beach mark, bearing S. by E. $\frac{1}{4}$ E., which mark will lead up to and westward of the black pillar buoy on the north-east side of the bar; thence steer midway between the red conical buoys on the starboard hand, and the black can buoys on the port hand (Liverpool system of buoyage), to abreast Hilbre island, within which the Trinity House system of buoyage is established; but here the banks are subject to much change, and the services of a pilot are necessary for Salisbury gut, Dalpool deep, and Parkgate deep; therefore it is useless to attempt directions for them.

The streams of both flood and ebb set fairly through Hilbre swash at the rate of 2 to $3\frac{1}{2}$ knots an hour.

ANCHORAGES.—**Wild road and Mostyn deep.**—In Wild road there is good anchorage in moderate weather in from 5 to 6 fathoms, just southward of south-east Air buoy, but in Mostyn deep there is more room and far better shelter; a good position is just above M. 1 buoy, abreast the quay, in 6 to 7 fathoms.

The bar between Mostyn deep and Wild road has about 13 feet at low water springs, eastward of S.W. Salisbury buoy.

Dalpool deep, on the east side of the estuary, is a secure anchorage, with depths of $2\frac{1}{2}$ to 3 fathoms, over gravel and mud, and is in some respects more convenient than either of the above. Here landing can be effected abreast the white cottage at any time of tide, and it is within 11 miles of Birkenhead by the railway.

With strong north-west winds, towards high water, there is, however, a nasty sea in Dalpool.

The tidal streams run with a velocity of $2\frac{1}{2}$ to $3\frac{3}{4}$ knots in Mostyn deep and Dalpool, but does not exceed 3 knots in Wild road.

Pilots for the Dee are generally to be found off the entrance, and in moderate weather they cruise between it and Llandudno. Liverpool pilots are also empowered to take charge of any vessels as far as Wild road and Dalpool, where, as well as at Hilbre island, Chester pilots may be obtained. Steam tugs will generally be found off Air point. *See Towage*, p. 331.

TIDES.—It is high water, full and change, at Air point, at 10h. 54m. local, 11h. 7m. Greenwich time; ordinary springs rise 25 feet, and neaps 19 feet; and at Hilbre island, at 11h. 0m. local time, springs rise $26\frac{1}{2}$ feet, neaps 22 feet; equinoctials rise $2\frac{1}{2}$ feet more than ordinary springs. The rate of the stream in Wild road does not exceed 3 knots per hour, but in Mostyn deep and Dalpool it is nearly 4 knots at times, as above stated.

In Greenfield gut, above Mostyn, the flood begins three-quarters of an hour after low water at Hilbre island.

At Connah's quay, the flood begins $4\frac{3}{4}$ hours after low water at Hilbre island, running for 2h. 10m., and the ebb about $10\frac{1}{2}$ hours; the rise of ordinary springs is 11 feet, and of neaps 4 feet.

At Saltney, and Cranes wharf, Chester, it is high-water at 0h. 16m. local time, or 53 minutes later than at Liverpool; an ordinary spring rises 10 feet, and the duration of the flood is about two hours.

Bore of the Dee.—Caution.—It is necessary for vessels navigating the Dee to guard against the tidal bore to which the river is subject; it begins abreast Rock cliff hall, one mile below Connah's quay, attains its greatest height of 2 feet at Sandycroft, and moves at the rate of 8 miles per hour. The first of the flood is generally the strongest, and vessels lying alongside quays should look well to their fastenings, for much damage at times takes place from neglecting this precaution. The bore is not dangerous to boats if they are in the

middle of the river, but upon the shore they are liable to be swamped or stove.

UPPER NAVIGATION.—Above Flint, situated 9 miles above Air point, the estuary is wholly occupied by sands; the narrow channel or depression in the sands is marked by perches. The shallow and shifting channels between Parkgate and Flint are fordable in places towards low water, but many persons have lost their lives in crossing, by the tide overtaking them. No description of such navigation will therefore be attempted, but a brief notice will be given of the various shipping-places on the banks of the Dee between the sea and Chester. *See Bore*, p. 329.

Llawndy gut, about one mile within Air point, and abreast Wild road, has been dredged to accommodate small coasting craft. A quantity of coal is shipped from the colliery wharf at the head of it, alongside which, and in the approach, there is a depth of about 10 feet at high water springs; the south side of the channel is marked by perches.

Mostyn quay, situated nearly 3 miles within Air point, is protected from silt by a rubble pier, nearly half a mile in length on its upper or south side, and by a short pier, with flagstaff, on its north side; between which the gut dries from 5 to 6 feet at low-water springs. There is a tidal basin affording considerable accommodation alongside the quays, frequented by vessels of about 12 feet draught. There are large works for smelting iron here. The Chester and Holyhead railway passes close to the head of the quay, and has a station there.

Mostyn is a creek of Chester custom-house.

Llannerch-y-mer wharf.—At $1\frac{1}{2}$ miles above Mostyn, is Llannerch-y-mer gut, dry about 10 feet at low water. A sea wall extends half a mile below it, with depths of 18 feet alongside at low water, the channel of the river being close against it. At half a mile below the gut, just below M. 2 buoy, a groyne has been run out; it is covered at high water, but its extreme is marked by a perch.

At **Greenfield**, 3 miles above Mostyn, there is a depth of about 8 feet at high-water springs in the gut; a groyne or pier, marked by perches, extends from its north point; the deepest water in the approach is marked by buoys and perches.

At **Bagilt**, or Dee bank, 2 miles higher up, are large smelting works, which employ many small vessels in the conveyance of lead, copper, and other ores. Vessels of 8 feet draught reach it at high-water springs.

Flint, although the county town, has but little trade ; it is chiefly remarkable for the ruins of its old castle, standing close to the coast. Vessels of from 100 to 200 tons are here built, as they are also at Connah's quay, and such of 9 feet draught reach Flint at high-water springs. There is a small pool, with 30 feet at low water, close to the head of the pier.

Connah's quay, or St. Marks', is also a creek of Chester custom-house.

Connah's quay is $7\frac{1}{2}$ miles below Chester, and nearly at the point where the estuary has been abruptly contracted by artificial embankments. There are depths of one to 8 feet alongside the quay at low-water springs ; here timber ships discharge their cargoes, which are rafted up to Chester. Vessels drawing 11 feet may reach it at springs, and those of 5 feet at neaps.

Connah's quay is connected by railway with Wrexham, besides being on the Chester and Holyhead line. The new line of railway opened in 1889, crosses the Dee above Connah's quay ; a swing bridge allows vessels to pass through.

At **Queensferry**, 2 miles above Connah's quay, there are quays, and a considerable trade in coals, slate, tiles, bricks, and patent fuel. At low-water there is not more than 2 or 3 feet, but vessels of 10 and 5 feet draught reach it at high-water springs and neaps, respectively. Besides this ferry there is another across the river, one mile below Saltney, both of which are free.

At **Saltney**, the property of the Great Western Railway Company, one mile below Chester, there are good quays, and a brisk trade is carried on in vessels of from 100 to 150 tons burden, chiefly in coals, iron ore, china clay, &c. A branch of the Great Western Railway connects it with Shrewsbury and the interior, and another branch, from near it, with Mold and Denbigh.

As the river is only navigable for vessels of 9 feet draught to Saltney at high-water springs, it is the cause of much delay. Vessels of a larger class usually go down light to Mostyn deep, and there take in their cargoes, which are conveyed in flats from Chester and the other shipping-places.

Towage.—Steam-tugs are stationed in the Dee, and have plenty of employment at spring tides ; the usual practice is to tow several vessels at the same time.

CHESTER, a city and county of itself, is 179 miles by railway from London, and 21 miles from Liverpool ; it stands upon a rocky elevation on the north bank of the Dee, by which river it is nearly half surrounded. There are many handsome erections within the

city, such as the cathedral, exchange, and castle, the latter a splendid structure, built upon the site of the ancient castle, nearly all of which has been removed. The river is crossed by railway and road bridges; the new road or central bridge having but one arch of 200 feet span. Chester had formerly a far larger and more important trade than that of late years. Now only vessels of 100 to 150 tons burthen go up to the quay at Saltney, and to Crane wharf and Cheese stage, below the railway bridge. At the wharf, vessels will lie afloat at low water if not drawing more than 7 feet; at the stage there is a depth of 12 feet. A few vessels are built of from 100 to 200 tons, as also at Saltney.

The population in 1881 amounted to 36,788.

LIVERPOOL BAY.—RIVER MERSEY.

General Remarks on the Entrance channels.—Depths in river.*—The entrance to the Mersey lies between Hilbre and Formby points, about 10 miles apart, and is obstructed by banks to the distance of 6 to 8 miles off-shore, all well guarded by lights and buoys, rendering the approach a matter of no difficulty during moderately clear weather.

Between these banks there are three entrance channels.

The centre one, which is the deepest, and therefore the most important, is the Queen's and Crosby channel; it has a depth of 11 to 12 feet on its bar at low-water springs, 25 feet at half-tide, 31 feet at high-water neaps, and 38 feet at high-water springs.† This bar is very short, and lies between the Bar and Formby light-vessels, nearly 10 miles north-westward of the river entrance points. Within the bar there is water in the channel of the river for all classes of vessels to lie afloat, but most vessels dock on arrival.

Vessels of 15 feet draught can navigate to Runcorn, situated about 18 miles above the entrance, at high-water springs, and those of 7 feet to Warrington, about 25 miles above the entrance. *See* Upper Mersey, p. 356.

Horse channel, on the south shore of Liverpool bay, is barred at its inner end, abreast Rock lighthouse, by a flat with 3 feet only at low-water springs, known as Rock gut; it has a depth of 17 feet at half-tide, 23 feet at high-water neaps, and 30 feet at high-water springs.

* *See* Admiralty chart of Liverpool bay, No. 1,951; also No. 1,170 *b.*, with its approaches. Views of the principal shore and floating objects used for the navigation of the entrance of the Mersey are given on these charts.

† These depths apply to the datum referred to on chart No. 1,951.

Formby channel, the northern entrance, is barred at its inner end abreast Crosby lighthouse ; the depths are the same as on the Rock gut, the bar of the Horse channel, just mentioned.

Upper river.—The Mersey, forming a natural boundary to the counties of Lancashire and Cheshire, has its source 7 miles eastward of Stockport. Flowing onward, with numerous bends, through a level country, past Stretford, Ashton, and Flixton, it is joined, in the vicinity of Carrington, by the Irwell, from Manchester, and from thence, aided by weirs and locks, becomes a navigable river. The banks widen out considerably towards Runcorn, but at Runcorn Gap the breadth is contracted to one-quarter of a mile. Here the Mersey is crossed by the London and North-Western railway viaduct, which has three navigable arches of 305 feet each, with a height of 75 feet between the level of high-water. Two miles below Runcorn the river is joined by the Weaver from the south-eastward, and expands into a wide estuary, the greatest breadth of which is 3 miles across near Ellesmere port. In this portion, nearly 4 miles above Rockferry, on the Cheshire side, is the entrance to the Manchester canal, in course of construction. From thence it gradually contracts, and from Rockferry to Rock lighthouse, the last 5 miles of its course, the river is from one mile to half a mile wide, the narrowest part being between the walls of Prince's basin and Seacombe ferry. The length of the estuary from Runcorn Gap to Rock lighthouse is 16 miles, and the total length of the Mersey from its source about 80 miles.

Limits of the port.—The Customs limits of the port commence at Hilbre point in Hoylake, where the boundary of Chester terminates, and continue up the river Mersey to Ince ferry, thence crossing the river to Dungeon point, and along the Lancashire coast to a stream of water commonly called the Hundred End, on the south side of the river Ribble, and extend seaward to the distance of 3 miles from the low-water mark. The boundary between the Lower and Upper Mersey is between Eastham and the south end of Garston docks.

ASPECT.—**South side of entrance.**—Hilbre point and the coast eastward to New Brighton, at the entrance to the Mersey, being composed of low sand-hills, are but indistinctly seen from the sea ; but the monument on Grange hill, $1\frac{1}{2}$ miles within Hilbre point, and Irby hill, 286 feet in height within, are well-marked objects. On the eastern part of the same range will be observed the square tower of Wood church, and north-east of it Bidston hill, with its lighthouse, observatory, and mill. The towers of the old and new

churches of Wallasey lie north-eastward of these, and separated from them by the low land bordering Wallasey pool and Birket stream ; upon the same rise is also a square waterworks tower.

The chief objects upon the lower foreground, more particularly to a vessel using the Horse channel from the westward, are Hoylake lighthouses and church, Leasowe lighthouse, a little within the sea embankment, and three-quarters of a mile eastward Leasowe castle. Rock lighthouse and the adjacent fort, nearly 3 miles eastward of Leasowe castle, are both insulated at high water ; these, together with the conspicuous church spire of New Brighton, terminate the intervening 7 miles of coast between the estuaries of the Dee and Mersey.

East side of entrance.—Formby point and the coast for 5 miles south of it is composed of low sand-hills, over which may be seen the belfry of Formby church ; on the shore westward of the church is a disused lifeboat house and flagstaff. Northward of the point are the framework beacons for the fairway of Formby channel, and about 2 miles southward of the point is Formby tower, with the Victoria sea mark on the coast seaward of it.

Farther southward is Crosby lighthouse, with a beacon on the sands, and 2 miles beyond is Crosby point, projecting little from the coast on either side, but having several prominent objects about it, namely, the old and new churches of Crosby, a Roman Catholic chapel, and a windmill.

Upon the sands in front of the point are the two north and two south marks of the measured mile for testing the speed of steamers.

The yellow tower of Seaforth church, and Bootle and Walton churches on the ridges within it, are somewhat conspicuous.

There are many prominent objects in Liverpool, but they are of no use in the approach, and are always obscured by smoke in easterly and south-westerly winds.

Beaching.—A sandy beach skirts the whole of the south shore, and between Hoylake lighthouses and Leasowe castle is a bed of peat and mud, which is well calculated for beaching on without injury to any vessel that may be compelled by stress of weather to run ashore.

LIGHTS.—Hoylake.—From a white tower on the shore at Hoylake is exhibited, at an elevation of 31 feet above high water, a *fixed white* light, visible in clear weather from a distance of 11 miles ; it is obscured westward of the line of bearing S. $\frac{1}{3}$ E., or over East Hoyle bank. Upper Hoylake light is discontinued, but the lighthouse remains.

Dove beacons.—*Fixed red* lights are exhibited from the Dove beacons, at elevations of 30 and 60 feet above high water, and when in line bearing S.E. $\frac{3}{4}$ S. form a leading mark for a portion of the Horse channel.

Leasowe.—From a light-tower at Leasowe, painted white, 110 feet in height, is exhibited, at an elevation of 96 feet above high water, a *fixed white* light, visible at a distance of 15 miles in clear weather. It is masked when bearing southward of S.S.E., the line of obscuration passing about one cable westward of the Bar light-vessel.

Bidston.—From a dark coloured stone tower, 68 feet in height, erected on Bidston hill, is exhibited, at an elevation of 214 feet above high water, a *fixed white* light, visible from a distance of 23 miles in clear weather. This light is masked when bearing southward of S.S.E. $\frac{1}{4}$ E., or on a line passing about one cable eastward of the Bar light-vessel.

The Rock.—From a white stone tower, 94 feet in height, erected on the north extreme of the low-water ledge (on which also there is a fort), extending northward from New Brighton pier, is exhibited, at an elevation of 63 feet above high water, a *flashing white* light *every twenty seconds*, visible at the distance of 14 miles in clear weather.

A *fixed white* light is shown beneath the flashing light in the direction of Rock channel, and south-eastward towards the river, while there is a depth of not less than 11 feet in Rock gut. A black ball hoisted by the side of the lantern denotes the same depth by day.

Fog signal.—Two bells, each having a different note, are sounded alternately at the rock, *once every ten seconds*, during foggy weather.

Crosby.—From a square white light-tower, 74 feet in height, erected near the shore between Formby and Great Crosby villages, east side of entrance to the Mersey, is exhibited, at an elevation of 82 feet above high water, a *fixed white* light, visible between the bearings of S.S.E. $\frac{3}{4}$ E. and E. $\frac{1}{4}$ N. from a distance of 15 miles in clear weather; the first bearing leads over the south-west extreme of Formby spit in 12 feet, the second bearing cuts the Horse Fairway bell beacon, and leads northward of Newcome knoll.

North wall.—From a lighthouse on the North wall, east side of entrance to the Mersey, is exhibited, at an elevation of 56 feet above high water, a *fixed white* light, visible between the bearings N. by E., through east, and S. by E. $\frac{7}{8}$ E., from a distance of about

15 miles in clear weather. Within the river the intensity of the light is diminished in clear weather when bearing northward of E. by N.

Fog signal.—During thick or foggy weather a siren at the North wall gives a blast of *three seconds duration every thirty seconds*.

LIGHT-VESSELS.—The light-vessels off, and in the entrance of, the Mersey are four in number, and are named North-west, Bar, Formby, and Crosby.

NORTH-WEST LIGHT-VESSEL lies in 13 fathoms in the fairway of the approach to the several channels, with Bidston lighthouse in line with the Horse Fairway bell beacon, bearing S.E., and the Bar light-vessel E. by S. $\frac{1}{2}$ S., distant 8 miles; lat. $53^{\circ} 30' 52''$ N., long. $3^{\circ} 3' 48''$ W.

From the vessel is exhibited, at an elevation of 30 feet above the sea, a *revolving white light every half minute*, visible in clear weather from a distance of 11 miles.

This vessel has two masts, and she carries a black ball at the foremast head; her hull is painted red, with "N.W. LIGHT-SHIP" in white letters on her sides.

Fog signal.—During thick or foggy weather a powerful steam fog horn gives every minute *three blasts* each of *two seconds* duration, within a period of *fifteen seconds*, followed by *forty-five seconds* silence; when the horn cannot be used a bell will be sounded.

BAR LIGHT-VESSEL lies in $7\frac{1}{2}$ fathoms, E. by S. $\frac{1}{2}$ S., 8 miles from the N.W. light-ship, and 2 miles outside the Queen's channel bar, with Formby light-vessel bearing E. by S. $\frac{3}{4}$ S., distant $3\frac{1}{2}$ miles, and in line with Crosby lighthouse.

From the vessel, at a height of 30 feet above the sea, is exhibited a *flashing white light*, showing *three flashes in quick succession every half minute*, visible in clear weather from a distance of 10 miles. Flash 2 seconds, eclipse 2 seconds, flash 2 seconds, eclipse 2 seconds, flash 2 seconds, eclipse 20 seconds.

The vessel is painted red, with "Bar" in white letters on her sides, has two masts, with a red ball on each.

Fog signal.—During foggy weather a steam horn is sounded giving *one blast every twenty seconds*; when the horn cannot be used a bell is sounded.

FORMBY LIGHT-VESSEL lies in about 8 fathoms, $1\frac{3}{4}$ miles within the bar of Queen's channel, and on the line joining Bar light-

vessel and Crosby lighthouse ; with Crosby lighthouse just open northward of Crosby beacon.

From the vessel is exhibited, at an elevation of 30 feet above the sea, a *flashing red* light, *every twenty seconds*, visible in clear weather from a distance of about 8 miles.

She is painted red, with "Formby" in white letters on her sides, and has two masts, with a black ball at the foremast head.

Fog signal.—During thick or foggy weather a fog horn gives, every minute, *four* blasts, each of *two seconds* duration, within a period of *fifteen seconds*, followed by *forty-five seconds* silence. When the horn cannot be used a bell will be sounded.

CROSBY LIGHT-VESSEL, moored abreast the north-east elbow of Great Burbo bank, and at the turn of Crosby channel, in 7 fathoms, constitutes the fairway beacon to and from the Mersey through Crosby channel.

From the vessel is exhibited, at an elevation of 29 feet above the sea, a *flashing white* light *every ten seconds*, visible 8 miles in clear weather. This vessel is painted red, with "Crosby" on her sides, and has two masts, with a red ball at the foremast head.

There are patches of $2\frac{1}{2}$ to 3 fathoms between the vessel and the black buoys, C. 4 to C. 6, but as the depths are considerably more than on the bar, they need not be considered dangers ; the proper channel is southward of the light-vessel.

Fog signal.—During thick or foggy weather a steam horn gives *one* blast *every twenty seconds*. When the horn cannot be used a bell will be sounded.

GAS BUOYS.—Askew spit.—A gas buoy, red conical, marked C. 4, showing a *flashing* light, marks the north-east edge of Askew spit, Great Burbo bank, at $2\frac{1}{2}$ cables south-westward of Crosby light-vessel.

A red conical light buoy, C. 8, showing a *flashing* light, is placed on the east edge of Great Burbo bank, west side of Crosby channel, $2\frac{3}{10}$ miles southward of that on Askew spit, and nearly abreast the inner measured mile beacons.

A gas buoy, can shaped, black, marked C. 8, showing a *fixed white* light, marks the east side of Queen's channel, N.E. $\frac{1}{4}$ N., distant 8 cables from C. 8, red buoy.

BUOYAGE.—The uniform system is adopted in buoying the several channels to the Mersey, and is such that, coming upon a buoy in the night the seaman may know by its shape on which side of the channel it is situated. An uniform system with respect to

colour is likewise maintained as far as circumstances will allow. Thus, when inward bound, conical buoys are to be left on the starboard hand, can buoys on the port hand, and spherical buoys on either hand; the conical buoys are painted red, can buoys black, and spherical buoys with horizontal stripes. On the buoys of every channel are painted the initial letter of the channel, with a number, the numerals being arranged in consecutive order, reckoning from seaward; thus a conical buoy, marked Q. 1, or a can buoy Q. 1, denotes, respectively, the outer buoy on either side of Queen's channel, the next buoys inward being marked Q. 2, and so on for other channels. Fairway buoys bear the initial letter of their channel, and "Fy.," and have distinct characteristics of form and colour. *See* Uniform system of buoyage, p. 19.

SAND BANKS.—The numerous sands which encumber the entrance of the Mersey will be better understood by a reference to the chart than by reading the most elaborate description, in fact any attempt to convey by words correct ideas of the extent and form of these banks, and the intricate channels between them would be useless; it must therefore suffice to mention them in general terms.

EAST HOYLE BANK.—East Hoyle bank, as forming the east side of Hilbre swash, has been described on page 325; its eastern edge forms the West side of Horse channel, and is marked by red conical buoys; its continuation eastward is known as Mockbeggar wharf bank.

Buoys.—*See* Horse channel buoyage, page 346.

Hoylake sand.—Two red conical buoys are placed a quarter of a mile off shore on Hoylake sand, half a mile apart, to mark the best channel at high water for the fishing craft that lie aground off Hoylake; the eastern one, marked L. 1, lies abreast the Dove beacons; the western one is marked L. 2.

Mockbeggar wharf bank is a sand flat fronting the south coast from abreast the Dove beacons to Rock lighthouse, and having an average breadth of half a mile; R. 2 and R. 3, conical red buoys, mark the north edge of its western portion.

NEWCOME KNOLL is a detached bank, about 7 cables in length, with depths of 16 to 18 feet at low-water, situated between the Horse fairway bell buoy and the Great Burbo bank.

Buoy.—A spherical buoy, painted in black and white horizontal stripes, with staff and diamond, marked K, in $3\frac{1}{4}$ fathoms, is placed at the west end of the knoll, with Hoylake light bearing S. $\frac{3}{4}$ E., distant $5\frac{1}{16}$ miles, and Horse fairway bell buoy W. $\frac{1}{4}$ N.

Six and Four-foot flats is the name applied to the shallow water extending northward from Spencers spit, the depths on which increase gradually to seaward.

Deposit buoy.—A red and white horizontally striped can buoy, with staff and diamond, lies about one mile northward of North bank; it marks the place where dredged material is deposited.

SPENCERS SPIT, North bank, and Brazil bank, the extension south-westward of Great Burbo bank, form together the north side of Rock channel, and extend parallel to Mockbeggar wharf, on the south side of the channel. Spencers spit dries from 5 to 8 feet, North bank about 16 feet, and Brazil bank 5 feet, above low-water springs.

Buoys.—Their southern edges are marked by the Horse channel buoys, *see* p. 346.

BURBO BANKS.—Great Burbo bank dries at low-water over a space 5 miles in length by $2\frac{1}{2}$ miles in width, and separates Rock channel from Crosby and Queen's channels.

The highest part of the bank, situated about one mile within Brazil bank at its south-east extreme, dries 19 feet at low-water; one mile within Askew spit, at its north extreme, it dries 13 feet; between these positions the bank is lower, with several swashways running through it in an east and west direction, but being subject to frequent change are not used by vessels.

The east and north, or channel sides of the bank, are steep-to in most places, but the west side shelves gradually into deep water. The north-west portion, beyond the part dry at low-water, is named Great Burbo flats. Four and Three-fathoms tongue, with depths ranging from 16 to 30 feet, extends about 5 miles westward of the dry portion of the bank. During strong westerly winds with ebb tide, a short cross sea gets up over this irregular bottom, which small craft should avoid.

Little Burbo bank is the north-westerly continuation of Great Burbo bank. Within a depth of one fathom it is $1\frac{1}{2}$ miles in length, and its centre portion is awash at low-water springs. It is connected to Zebra flat by a ridge with about 11 feet water, which ridge is the bar of Queen's channel.

Buoys.—The buoys marking these banks are Queen's channel buoys, *see* p. 344.

ZEBRA FLATS, Jordan and Taylor banks, from the north side of Queen's and Crosby channels, trending parallel to the

north edges of Burbo banks ; they also separate Queen's channel from Formby channel.

Jordan and Taylor banks are connected at low water, and dry over a space $3\frac{1}{2}$ miles in length, with an average breadth of one mile, and to a height of 10 to 12 feet in places ; they are fairly steep-to on their south or channel sides.

Zebra flats are the extension westward of Taylor bank, to the distance of about 2 miles, the depths gradually increasing from the bank to 3 fathoms at that distance.

Buoys.—A black and white vertically striped conical buoy, with staff carrying a flat disc, marked Z., lies half a mile off the north side of Zebra flats, in $4\frac{3}{4}$ fathoms, with Q. 1 black buoy bearing S.W $\frac{1}{2}$ W. $1\frac{1}{4}$ miles, and Crosby lighthouse S.E. $\frac{3}{4}$ E. $6\frac{1}{2}$ miles.

The south side of Zebra flats, Taylor and Jordan banks, and the west side of Formby bank are guarded by the Queen's and Crosby channels buoys, can buoys painted black, *see* p. 344.

The north and eastern sides of Jordan bank, form the south and west sides of Formby channel, and are marked by conical red buoys, *see* p. 349.

FORMBY SPIT, Mad-wharf, and Formby bank are portions of an extensive flat, which projects from Formby point to abreast Crosby point, from whence it continues as a broad and regular shelf up to Liverpool docks. Mad-wharf sands dry off about one mile from the shore northward of Formby point, thence sloping gradually seaward to Formby spit, on which there is a depth of 2 fathoms only at 3 miles from the coast.

Formby bank dries to the distance of $1\frac{1}{2}$ miles off Crosby light, southward of which it is reduced to about half a mile, terminating at North Wall.

Buoys.—*See* Formby channel, p. 349.

BANKS IN THE RIVER.—The foregoing are the principal sands encumbering the entrance to the Mersey ; having passed Rock lighthouse, the channel within is free from banks to George's landing stage. The foreshore, however, dries off to nearly 2 cables on the Cheshire shore, to near the end of the landing stages, but on the Liverpool side to a short distance only. The low-water breadth of the river decreases gradually from seven-tenths of a mile abreast New Brighton to four-tenths of a mile at Seacomb ferry and the Liverpool landing stages, southward of which it again widens.

Pluckington bank faces the southern division of the Liverpool docks, from the south end of George's stage to Coburg dock ; the position and height of the portion which dries, varies considerably.

In 1888, the greatest extension, $1\frac{1}{2}$ cables, was off the Queen's half-tide dock; near the Canning half-tide dock it dried 9 feet. Depths of less than 3 fathoms extend nearly 4 cables off shore towards Sloyne road, southward of this bank.

Devil's bank, the name applied to the north end of Eastham sands, westward of Dingle point and in mid-river, is also subject to change; the least depth in 1888 was one foot.

Buoys.—A spherical buoy, painted black and white in horizontal bands, with staff and diamond, in 10 feet, marks the north end of Devils bank, with Herculeum dock island bearing N.E. $\frac{3}{4}$ E. distant 3 cables. A black and white vertically striped conical buoy, with the letters G. R., and diamond on it, marks the edge of the rocky ledge extending from Dingle point. Between these buoys is the channel to Garston, p. 356.

Cheshire shore bank.—From Tranmere stage, north end of Sloyne road, the foreshore composed chiefly of sand, with rock in places, dries off a quarter of a mile, or nearly to the ends of the Tranmere, Rocky Ferry, and New Ferry stages, and to 3 cables off the Candle Works; a short distance above, the foreshore is rocky and extends only about half a cable.

TIDES.—It is high-water, full and change, at the North-west light-ship at 11h. 0m. local, 11h. 12m. Greenwich; ordinary springs rise 25 feet, neaps 20 feet. Liverpool, 11h. 23m. local time; springs rise $27\frac{1}{2}$ feet, neaps $20\frac{1}{4}$ feet. A continuance of easterly winds at about spring tides, also equinoctial springs, will cause the tides to be from one to $1\frac{1}{2}$ feet lower.

The datum, from which those heights are reckoned, is $8\frac{3}{4}$ feet below the Old Dock sill, but the soundings on the charts are reduced $1\frac{1}{4}$ feet more, or 10 feet below the sill. The Old Dock sill is the point to which all the levels are referred; this level is preserved on a tide gauge at the west side of the centre pier of the entrances to Canning half-tide dock. Upper Mersey, *see* p. 359.

Tidal streams.—During spring tides the ingoing stream to the river continues for half an hour after the water has ceased to rise, and the outgoing stream for the same period after it has ceased to fall; but this interval becomes gradually less towards neap tides, when the turn of the stream and rise and fall of the tide nearly coincide. Speaking in general terms, the stream in the bay may be described as setting toward the Mersey with the flood, and from it with the ebb, noticing that at the earlier part of the flood, and latter part of ebb, it sets into and from the several channels through the banks; but when the banks are covered, it sets over them from all parts of the bay in lines of direction converging towards the river entrance at Rock lighthouse.

Both streams turn in the bay when the water ceases to rise or fall, which occurs 18 minutes earlier than at George's pier at Liverpool. Their velocity at springs at the North-west and Bar lightships is about 2 knots, and at neaps one knot; equinoctial springs run about half a knot faster.

At the North-west lightship the flood runs E.S.E. and the ebb W.N.W.

At the Bar lightship the flood sets towards Rock lighthouse, or S.E., and the ebb in the opposite direction, throughout each tide.

From the sea channels, up to the river entrance, the rate of the stream gradually increases to 4 or 5 knots at springs, and at equinoctial tides, a rate of 7 knots in the narrowest part of the river channel, which is abreast the north end of Prince's dock.

Near Newcome knoll the flood stream sets south-east for the last 4 hours, and the ebb north-west for the first 4 hours.

About 2 miles northward of Chester flats and West Hoyle spit, entrance to the Dee, the set of the flood stream towards Liverpool bay occurs 20 minutes earlier, and the ebb 30 minutes later than nearer the shore; the velocity at springs is $3\frac{1}{2}$ knots, and at neaps 2 knots.

One mile northward of Formby fairway buoy, the direction of the stream is towards and from the Ribble; a sailing vessel should therefore guard against this influence if bound for Liverpool, as with a westerly wind, or a calm, she would be hardly able to gain the entrance to Queen's channel, and might have to anchor under unfavourable circumstances.

Pilots.—The Liverpool pilots cruise in fore-and-aft schooner rigged vessels, each vessel having her number painted on the mainsail, foresail, and staysail, and also on each bow.

It is compulsory upon all merchant vessels entering Liverpool, except coasters in ballast, or under 100 tons register, to take a pilot, and in the event of refusing one when offered, pilotage rates are, nevertheless, levied, and in cases where a vessel cannot be boarded, a pilot boat leading in is reckoned as pilot service.

Off Lynus point is the westernmost station appointed for the cruising of the Liverpool pilot boats; occasionally when driven by stress of weather, they may be met with farther to the westward, and in strong easterly winds board their pilots in Holyhead bay, southward of Carmel head. Two vessels are usually on the westernmost station. They are painted black, with a narrow yellow streak, and white at the water-line. So long as any pilots remain unboarded, they carry a large flag at the main-topmast head, the upper half white and lower red, and at night are recognised by a single bright mast-head light, with an occasional flash torch. Between this station and

Liverpool bay three other boats are stationed, so that should this station be passed without receiving a pilot, a course may be shaped for the N.W. and Bar light-ships, constituting the fairway guide to Queen's channel; if the signal for a pilot be kept flying, it can rarely happen that the N.W. light-ship will be reached without the vessel being boarded.

Every vessel while in charge of a pilot is required to hoist the distinguishing flag with which each pilot is provided; and, at night, should she be chased by a pilot-boat, the fact that she has a pilot on board should be signified by hoisting a light, which light must be lowered and re-hoisted every five minutes, as long as the vessel continues to be chased.

Pilots are instructed to cause the ensigns of all ships to be hoisted on entering the port.

Pilots in charge of ships outward bound are required to conduct them, according to the channel they take, either to the N.W. buoy of Horse channel, the Bar light-vessel, or Formby N.W. buoy, and in case of a pilot quitting the vessel against the master's consent, and without fulfilling his obligation, all pilotage money which otherwise would have been due becomes forfeited.

A pilot boat is always in attendance seaward of the entrance of the channels for the purpose of receiving pilots from outward-bound vessels.

The pilot service of the port of Liverpool is under the control of the Mersey Docks and Harbour Board; the Pilotage office is at the Canning half-tide dock, near No. 16 on plan.

A large fleet of steam-tugs is always available; they will be found as far down the Irish channel as Bardsey, and occasionally to the Smalls and Tuskar.

Lifeboats are maintained by the Mersey Dock and Harbour Board, at Air point, and Hilbre island entrance to the Dee, at Hoylake, and two at the Prince's stage, Liverpool. Besides which, the Royal National Lifeboat Institution has a station with two boats, one of which is tubular, at New Brighton; there are also belts and lines at Hoylake and Waterloo. All masters and others in charge of vessels entering or quitting the port of Liverpool, requiring the assistance of lifeboats, either for the preservation of life or other purposes, are requested to hoist the distress signal, in order that the boats may be dispatched as soon as possible.

Coastguard.—There are coastguard stations at Hoylake and Waterloo, on either side of the entrance. Liverpool is the headquarters of the division of the district.

Drill ship.—H.M.S. *Eagle* is stationed here as a drill ship for the Royal Naval Reserve.

QUEEN'S and CROSBY CHANNELS.—The Queen's channel, and Crosby channel its continuation south-eastward, through which the main stream from the Mersey discharges, is the widest and deepest entrance into the river. It is barred at the distance of 10 miles from the entrance points by the narrow ridge, 3 cables in width, connecting Little Burbo bank with the Zebra flats, on which there is a depth of 11 to 12 feet at low-water springs, 25 feet at half-tide, 31 feet at high-water neaps, and 38 feet at high-water springs, which depths, however, are liable to alteration during gales. Within the bar there is sufficient water for all classes of vessels, and the channel is nowhere less than 4 cables wide between the buoys.

Buoyage.—The channel is marked by three light-vessels, three light-buoys, and numerous other buoys placed at distances of about half-a-mile apart. Starboard hand buoys, on entering, are all conical, painted red, and distinguished by the initial letter of the channel, and numbered; port hand buoys are all can, painted black, and similarly lettered and numbered. Q. 1, red, carries a staff and ball; Q. 1, black, a staff and cage; Q. 6 buoys are the easternmost of the Queen's channel buoys; these are followed by the Crosby channel buoys, namely, C. 1 to C. X. on the starboard hand, and C. 1 to C. XI. on the port hand; within C. X., red, is Brazil bank buoy, black and white horizontally striped, with staff and triangle (also marking Rock gut entrance); and, lastly, the Rip Rap, red conical, eastward of Rock lighthouse.

C. 4, red, on Askew spit, and C. 8, red, each show a *flashing white* light at night, and C. 8, black, a *fixed white* light.

Directions.*—A vessel having arrived abreast, and half a mile northward of the North-west lightship, should steer E.S.E. for the Bar lightship, distant about 8 miles, allowing for tide, which sets S.E. or N.W., somewhat obliquely across the course; having previously calculated from Table B. in the Admiralty Tide Tables, or by other means, the depth of water over the bar. The Bar lightship may be passed on

* It has been already stated (p. 342), that pilotage for the Mersey is compulsory, and therefore there is no inducement to attempt entering without one. H.M. Vessels of war are an exception to this rule.

Steam ships and vessels in tow, when navigating in the sea channels or approaches to the river Mersey between Rock lighthouse and the farthest point seawards to which such channels are buoyed on both sides, are required, whenever it is safe and practicable, to keep to that side of the channel which lies on the starboard side of such steamships. Vessels at anchor are required to hoist at night an additional light over the stern, namely, a light visible all round; and at twice the height of the light on the forestay.

either side, but by passing northward a wider berth will be given to the Four and Three fathoms tongue, over which, during ebb tide, with westerly winds, there is a cross sea.

From Bar light-vessel steer across the bar (about 25 feet at half-tide) with Crosby lighthouse in line with Formby lightship, bearing E.S.E., between the red conical buoys on the starboard hand, and the black can buoys on the port hand; the vessel will be within the bar when abreast of Q. 3 black buoy. Pass southward of Formby lightship, between her and the red buoys (in accordance with the port regulations), thence S.E. by E. $\frac{1}{2}$ E. for Crosby lightship; also passing southward between her and Askew spit flashing light buoy, whence the course is S. by E. $\frac{3}{4}$ E. between the buoys, to abreast Rock light-house, thence to the docks or anchorage (p. 348).

In thick or foggy weather the constant use of the lead will keep a vessel clear of danger, but if a pilot cannot be picked up, it is advisable to anchor in a convenient depth, and keep the fog signal going, as required by the regulations.

It does not seem advisable to offer any directions for a sailing vessel working in, as it is absolutely necessary to employ the services of a pilot.

At night.*—The directions for entering at night are almost the same as those for daytime; the course from about half a mile northward of North-west light-ship to Bar light-ship being E.S.E.; thence across the bar, with Crosby shore light in line with Formby light-ship on same course. Pass close southward of the Formby, then bring her to bear W.N.W., astern, in line with Bar light-ship, for about one mile, or until Crosby light-ship bears S.E. $\frac{3}{4}$ E., then steer to pass midway between Crosby light-ship and the *flashing white* light buoy southward of her; thence with the Crosby light-ship astern bearing N. by W. $\frac{3}{4}$ W., the vessel will pass midway between the *flashing white* light gas buoy on the starboard hand and the *fixed white* light gas buoy on the port hand (C. 8 buoys); thence between Rock light and North Wall light (the latter light is obscured eastward of a line passing through C. 7 black buoy).

From abreast Rock light, the fairway to the docks or anchorage is clear of shoals; the only danger there is that arising from the number of vessels navigating the river at all times. The tidal streams within the bar set nearly in the line of the course. In crossing the bar during strong north-westerly winds, at which times there is a considerable sea, a vessel should wait until there is at least 5 feet more water on the bar than the draft of the vessel. Anchorage, p. 348.

* Bidstow and Leasowe lights are not visible eastward of the line joining them to the Bar light-vessel.

HORSE and ROCK CHANNELS and Rock gut, together 7 miles in length, form the south entrance to the Mersey. The least depth in this channel is 3 feet at low-water springs, in Rock gut, extending over a distance of one mile, by less than one cable in breadth; this gives a depth of 17 feet at half tide, 23 feet at high-water neaps, and 30 feet at high-water springs.

Horse channel, the seaward entrance, is contracted to a breadth of less than 2 cables between East Hoyle bank and Spencer spit, with depths of $3\frac{1}{2}$ to 5 fathoms, widening within, but the depths decrease in Rock channel to about 2 fathoms, thence gradually to 3 feet in Rock gut, as above.

Buoys.—Fairway.—A bell beacon buoy is placed in 7 fathoms, $1\frac{1}{2}$ miles off the north-west extreme of East Hoyle bank to mark the fairway of Horse channel. It lies with Bidston light open about one degree eastward of Leasowe light (which mark will lead to the entrance of Horse channel), Crosby lighthouse, E. $\frac{1}{4}$ N., and H. 1 buoy, red, the first buoy within, bearing S.E. $\frac{3}{4}$ S., distant $1\frac{1}{2}$ miles.

The Horse and Rock channels are buoyed in accordance with the Liverpool system, namely, conical red buoys on the starboard hand, on entering, and can black buoys on the port hand; these buoys are about half a mile apart, each buoy is numbered from seaward, and marked with the initial letter of the channel. The starboard hand buoys are eight in number, and marked from seaward H. 1 to H. 5, and R. 1 to R. 3, H. 1 being further distinguished by a staff with ball; all these black buoys mark the edges of East Hoyle bank and Mock beggar wharf bank. The port hand buoys are nine in number, marked H. 1 and H. 2, and R. 1 to R. 9; H. 1, with staff and cage, lies abreast H. 4 red; R. 1 is a bell beacon buoy. R. 9, black, is situated in Rock gut, south side of Brazil bank; the next and last buoy, on the north side of the gut, is the Brazil bank buoy.

The eastern entrance is marked by Brazil bank buoy on its north side, a spherical buoy, painted with black and white horizontal stripes, surmounted by staff and triangle; and a red conical buoy, marked Rip Rap, on its south side, 4 cables from the Brazil buoy; the best water is about one cable southward of the Brazil bank buoy.

Tidal streams.—In Horse and Rock channels the first half of the flood and last of the ebb sets fairly in and out, but after half flood and before half ebb, when the banks are covered, the tides set obliquely across Spencers spit, in a direction to and from Rock light-house.

Tidal signal.—A black ball hoisted at the Rock lighthouse by day denotes there is not less than 11 feet water in Rock gut; a *fixed white* light shown below the *flashing* light, visible from the westward, denotes the same depth.

Directions.*—From abreast the North-west light-ship, steer S.E. with Bidston lighthouse well open eastward of Leasowe lighthouse, which mark will lead up to Horse fairway bell buoy, and northward of the red conical buoys marking south side of channel as far as H. 4 red buoy. From abreast this buoy, between it and H. 1 black, with cage, steer in with lower Hoylake lighthouse, bearing S. $\frac{1}{4}$ E., until Dove beacons are in line bearing S.E. $\frac{3}{4}$ S., when steer for them until abreast R. 1 red conical buoy, and the black bell buoy; then edge to the eastward, to bring North Wall lighthouse in line with Rock lighthouse, E. $\frac{1}{4}$ S., and steer up Rock channel with this mark to abreast R. 4 black buoy and Leasowe lighthouse.

Thence pass about a cable southward of all the black buoys up to No. 7, but close to Nos. 8 and 9, and finally between Rock lighthouse and Rip Rap buoy on the one side, and Brazil bank buoy on the other, into the fairway of the Mersey, giving the lighthouse a berth of $1\frac{1}{2}$ cables, to avoid the rocky ledge extending northward from it, thence to the docks or anchorage above (p. 348).

Anchorage.—A vessel having arrived above Leasowe light, and the tide not having flowed enough to allow of her passing through Rock gut into the Mersey, may anchor in about 3 fathoms in Leasowe hole, between Nos. 5 and 6 black buoys. Or she may go farther in to Wallasey hole, between Nos. 7 and 8 black buoys, where are similar depths, but the available width here is little more than one cable at low water. Not many years ago the largest ships belonging to Liverpool could proceed to sea from these roadsteads at low-water, but now vessels drawing 16 feet cannot proceed outwards from them before first-quarter flood.

By night.—Horse and Rock channels are only to be considered available at night by those with local knowledge; the following directions might, however, prove of use should necessity (not likely to arise) cause a stranger to use them.

From abreast the North-west light-ship there should be no difficulty in identifying Bidston and Leasowe lights, which will be nearly in line; steer in with Bidston open one degree northward of Leasowe, bearing S.E., which will lead up to and northward of H. 4 red buoy. Immediately Hoylake light opens, steer in on its western limit,

* See foot note on p. 344.

bearing S. $\frac{1}{4}$ E., until Dove beacon *red* lights are in line, S.E. $\frac{3}{4}$ S., when steer for them until North Wall light is in line with Rock light, bearing E. $\frac{1}{4}$ S., when steer for them until eastward of the limit of Leasowe light; here the vessel should anchor.

But to proceed into the Mersey, open North Wall light northward of Rock light, and pass $1\frac{1}{2}$ cables northward of the latter into the Mersey, thence up the river, if desirable, to Sloyne road.

ANCHORAGES in the Mersey.—Sloyne road.—Quarantine ground.—The anchorage to be taken up in the river must depend on the vessel's destination. If bound to the docks, and having to wait for tide, she should anchor as soon as possible after the Ripraps buoy, off New Brighton, has been rounded, between Egremont and New Brighton, in about mid-channel off a sandy shelf, which is much resorted to as an anchorage. But if intending to proceed to Sloyne road*, where there are depths of 7 to 9 fathoms, or to the Quarantine ground above Sloyne road, where there are depths of 6 to 8 fathoms, mud, keep to the starboard (west) bank of the river, as required by the port regulations, and to avoid Pluckington bank with less than 3 fathoms at low-water, extending about 4 cables seaward of the southern division of the Liverpool docks, referred to on p. 340. It must, however, always be borne in mind in reference to anchorage that, abreast Rock lighthouse, the stream at springs runs at the rate of 4 knots, and in Sloyne road from 3 to 5 knots, per hour. A good scope of cable should be given, and a second anchor be ready for letting go, care being taken to sheer clear of the anchor when swinging; and at night to exhibit the anchorage lights, required by the port regulations, namely, an additional all-round light near the stern, at twice the height of the light on the forestay. Masters of vessels should obtain a copy of the port regulations on arrival.

FORMBY CHANNEL, the northern approach to the Mersey, is seldom used except by coasters. It lies between Formby spit, Madwharf bank and Formby bank, on the east side, and Jordan bank on the west; these banks dry from 5 to 6 feet in places at low water springs.

The channel is about 4 miles in length, with a least breadth of one cable at low water; the depths decrease from 15 feet at its entrance to about 3 feet on the bar at its south end, which is about 4 cables across, and connects it with Crosby channel. On this bar there will be a depth

* Pilots are under instructions to refrain from using the anchorage in the track of the Woodside ferry boats, whenever the prudent management of the ship will permit.

of 17 feet at half tide, 23 feet at high water neaps, and 30 feet at high water springs.

Buoys.—Formby North-west buoy, in the fairway of the approach, is a black and white horizontally striped pillar buoy, marked F.N.W. It lies in about $3\frac{1}{2}$ fathoms, on the line of the leading mark beacons, bearing S.E. by E. $\frac{3}{4}$ E. ; Madwharf, the near beacon, being distant 3 miles.

Formby channel is marked by six red conical buoys on the star-board hand on entering, and by two black can buoys on the port hand, all numbered and lettered. F. 1 and F. 2 red, lie parallel with the leading mark, F. 2 being at the turn of the channel and marking the north extreme of Jordan bank ; F. 3 to F. 6 red, mark also the east side of Jordan bank.

Formby South-west buoy, a spherical black and white horizontally striped buoy, with staff and triangle, marked F.S.W., lies on the east side of a sand bank which dries 2 feet, situated near the centre of the bar.

On the port hand, F. 1 can, black, lies abreast F. 2 red, distant $2\frac{1}{2}$ cables. F. 2 can black lies 7 cables southward of F. 6 red, at the north end of Formby deep, at the turn of the channel south-westward into Crosby channel. C. 5 black, in Crosby channel, is the next port-hand buoy.

Formby pool, with depths of 4 to 5 fathoms, lies between F. 4 and F. 6 red buoys.

Formby deep, with from $3\frac{1}{2}$ to $4\frac{1}{2}$ fathoms, lies between F. 2 black and Formby South-west buoy.

Directions.—In approaching Formby channel it must be remembered that the flood stream sets towards the Ribble, and the ebb in the reverse direction, or across the line of the leading mark.

Having arrived at the Formby North-west buoy, marking the fairway in about $3\frac{1}{2}$ fathoms at low water, the bar marks, namely North-west beacon mark in line with Madwharf bank beacon, will be seen in line, bearing S.E. by E. $\frac{3}{4}$ E. ; steer in on this mark until between F. 2 red and F. 1 black buoys, where the channel turns sharply to the southward ; thence steer S. by E. $\frac{3}{4}$ E. through Formby pool, passing half a cable eastward of all the red buoys and westward of F. 2 black. Here the channel turns south-westward through Formby deep, and the course is about S.W. by S., passing eastward of the spherical F.S.W. buoy into Crosby channel between C. 5 black can buoy and Crosby light-ship, when proceed as for Queen's and Crosby channels, p. 344.

Anchorage.—The water is generally smooth in Formby pool and

in Formby deep towards low water, and a vessel may await the tide here for crossing the bar into Crosby channel.

At night, North Wall light, in sight bearing S. by E. $\frac{3}{4}$ E., leads westward of Formby spit, and up to the Formby North-west buoy; the light is not visible north-eastward of this bearing. Crosby light is also masked so as not to show when bearing southward of S.S.E. $\frac{3}{4}$ E.; this limit leads over the extreme of Formby spit in 10 feet at low water, and between F. 2 red and F. 1 black buoys. When within these buoys a more southerly course must be kept towards the pool so as to avoid the flats. This channel could only be taken at night by a pilot.

LIVERPOOL.—This city, parliamentary borough, and seaport is situated on the east side of the estuary of the Mersey.

It occupies the slope of a moderately rising ground about $2\frac{1}{2}$ miles in length, the principal elevation being Everton hill at the north end, 230 feet in height, and Edgehill at the south end, 210 feet in height. From the latter three tunnels are cut through the red sandstone communicating from Edgehill station with the central terminus of the railway at Lime street, and with the docks at Wapping, and northward, to the Waterloo road and North docks. The Mersey tunnel under the river connects the railways on either side.

Liverpool has many handsome public buildings, such as the custom-house, town-hall, railway station, markets, and several churches, but the largest and most imposing erection is St. George's hall, in which, besides the necessary courts for the assizes, are large halls for festivals and other public meetings. At the entrance to the river is Seaforth battery, on the east side, and a small fort on the rocky ledge off New Brighton, on the west side.

The docks are, however, the most magnificent structures from a commercial point of view; these, as well as the river and its approaches, are under the control of the Mersey Docks and Harbour Board.

DOCKS.*—The Liverpool wet docks, over forty in number, extend in an almost unbroken line for a distance of $5\frac{1}{2}$ miles along the east bank of the Mersey from Seaforth onwards; they cover an area of 380 acres, with a quay space of $25\frac{1}{2}$ statute miles. The docks are

* For the detailed list of names and dimensions, *see* the Dock Book; the positions of the principal docks are denoted on the chart by a number, with a reference table at the bottom.

divided into the northern and southern divisions by the approaches to the Floating Landing stages, and are so arranged that a vessel can be transferred from one end of a division to the other, at high-water, without going into the river. The docks are fitted with special appliances for the trade by which they are generally used, and a large portion of the quay space is appropriated to shipowners having vessels trading constantly to and from the port.

There is a crane in the Langton Branch dock capable of lifting 100 tons, and there are about 100 large cranes in all; there is also a floating crane equal to weights of 30 to 100 tons.

Many of these wet docks are capable of taking the largest vessels afloat; those with the deepest water over the sills are the Herculeum, Alexandra, Hornby, Toxteth, Harrington, and Langton, each with a depth of 30 feet 10 inches at high-water springs; the widest entrance, 80 feet, is that to the Herculeum.

Works are in course of construction (1890) to connect the Herculeum system of docks with several others adjacent, which, when carried out, will enable the depth of water in any of these docks to be increased to any extent that may be required to float vessels of deep draught during neap tides.

Birkenhead wet docks have a frontage of about 5,100 feet to the river; they have a water area of 164 acres and a quay space of 9 statute miles. There are two entrances, the Alfred and the Morpeth, each with a depth of 30 feet 10 inches, which are in connection with the East and West Floats. Works are being carried out, by which the depth of water throughout the whole of the Birkenhead docks can be increased, so as to make all these docks fully available for all vessels that can enter by the Morpeth and Alfred entrances.

Dock signals.—A blue and red flag, kept flying on the pier-head at the entrance of each dock, signifies that vessels may not enter; the lowering of the flag implies permission to enter, and while it is down the dock is open to all comers. The dock gates are opened at about two hours before high-water, and are closed at the turn of the tide. If the flag is kept flying while the gates are open it implies that the dock is full.

At night the dock entrances and the dock wall are marked by *red* and *green* lights; at the principal dock entrances *electric* lights are exhibited when the gates are open and when vessels are being moved.

Graving docks.—The largest graving dock is on the Birkenhead side ; it is 750 feet in length, 85 feet in breadth, with a depth of $26\frac{1}{2}$ feet on sill at high water springs. The Herculaneum graving docks on the Liverpool side are about the same length, with a depth on sill of $22\frac{1}{4}$ feet. In the Sandon graving docks, six in number, 565 feet in length, special pumps will give any desired depth of water over the sills.

LANDING STAGES.—The Liverpool landing stage, $2\frac{1}{4}$ miles within the Rock lighthouse, is 2,060 feet in length, and 80 feet in width. It has seven bridges connecting it with the shore, besides a floating bridge 550 feet in length, and 35 feet in width, by means of which an easy incline for carriage traffic is maintained at all times of the tide. It is the only low-water landing place on the Liverpool side.

This stage, for the purposes of traffic, is divided into three parts, viz. ;—Prince's stage, Ferry Goods stage, and George's stage.

The Prince's stage, the northern one, is used by tugs, tenders, and coasting steamers, and has a depth of 17 feet alongside at low-water ordinary springs.

The Ferry Goods stage lies between the Prince's stage and George's stage, and is used for goods and carriage traffic between Liverpool and Birkenhead and Seacombe ; it has a depth of 6 feet alongside at low-water springs.

The George's stage is used by the ferry steamers to and from the Cheshire side, and has a depth of 7 feet alongside at low-water springs.

CHESHIRE LANDING STAGES.—New Brighton stage one-third of a mile from the Rock lighthouse, is connected by two bridges to a pier on piles which is 700 feet in length. The stage is used for ferry passenger traffic only, and has a depth of 7 feet alongside at low-water springs. The promenade pier forms a conspicuous object from the bay.

Egremont pier and slip is about $1\frac{1}{4}$ miles within New Brighton. The pier is 365 feet in length, and the moveable jetty, which runs on a slipway, and can be extended to low-water, is 380 feet in length. At the end of the tram slip there is a depth of 3 feet at low-water springs, at which time the pier is dry 5 feet.

Seacombe landing stage is connected to the piers by two bridges, and is used for passenger and goods and carriage traffic. One of the piers is provided with an hydraulic lift for raising carts

&c., from the floating stage when the tide is low; there is a depth of 14 feet alongside at low-water springs.

Wallasey landing stage, opposite the south end of the George's stage, is 350 feet in length, 70 feet in width, and is connected by two bridges to iron piers. It is used by ocean steamers for landing cattle. The depth alongside is 19 feet at low-water springs.

Woodside landing stage is 800 feet in length by 80 feet in width; it has two bridges and a floating bridge 678 feet long and 30 feet wide connecting it with the shore. The northern end of the stage is used for landing foreign cattle. The southern end of 300 feet, is used for the passenger and goods traffic from Liverpool. The depth alongside is 12 feet at low-water springs.

Tranmere stage, at north end of Sloyne road, is connected by a bridge to an iron pier, 720 feet in length. It is used for passenger traffic only; the depth alongside is 2 feet at low-water springs.

Rock Ferry slipway extends for 920 feet from the shore, with a depth of 5 feet at its extreme at low-water springs; it is used for passenger ferry traffic.

New Ferry stage, about half a mile above Rock Ferry and $2\frac{1}{4}$ miles above George's stage, is connected with a pier, 850 feet in length; it has a depth of 6 feet alongside at low water springs.

Eastham Ferry stage, $2\frac{3}{4}$ miles above New Ferry and about 5 miles above George's stage, is connected with a pier 60 feet in length. The passenger ferry steamers run to this stage during the summer only; the depth alongside is 7 feet at low-water springs.

Lights on Landing stages.—The distinguishing lights on the stages are as follows:—

Liverpool stage.—Prince's—north end—Green over two *white* in the form of a triangle; fog signals, north end, a triangle; south end, a horn. George's—south end—*red* over two *white* in same form; *green* lights on bridges; fog signal, a bell each end.

New Brighton.—*White* lights, centre one a dioptric light. Fog bell.

Egremont.—*White*, dioptric on centre of end of pier; *red* on bridge and end of standing pier; coal fire at end of moveable jetty.

Seacombe.—At ends of floating stage, *red* over two white triangular, other lights *white*. Fog bell.

Wallasey.—Two *white* horizontal at each end. Fog triangle.

Woodside—north end.—3 *red*, triangular. South end—3 *white*, horizontal; *green* on bridge. North end, fog horn; south end, bells.

Tranmere.—*Red* over two *white*, triangular, at centre of stage; other lights *white*. Bell in fog.

New Ferry.—*White*, dioptric. Bells and horns are used during fogs for ferry traffic.

Herculaneum dock.—On the south-west corner of the Herculaneum dock is a gas *white* light, which changes to *red* when bearing westward of N.W. by N., to indicate the eastern margin of the channel leading to the Upper Mersey.

Correcting compasses.—Time signal gun.—In the Mersey two special conveniences are provided for the practical purposes of navigation. First, Liverpool dock walls are marked with figures denoting the number of degrees from the magnetic North of the bearing of Vauxhall chemical works chimney, which is the highest chimney in Liverpool. These marks are visible from all parts of the anchorage, except in the extreme north or south, and whichever one happens to be intersected by the line of bearing of the chimney, signifies to the observer the angle from the magnetic North of the line of bearing; this, compared with the compass bearing, at once indicates the error of the compass, and by watching the bearing with the swinging of the ship, a table of deviation for every point of the compass through which the ship's head passes may be readily framed.

Chronometers.—Secondly, on the pier of Morpeth dock at Birkenhead, a little north of Woodside landing stage, a gun is stationed, which is fired every day at one o'clock p.m., Greenwich mean time, the time being regulated from the observatory on Bidston hill. This is accomplished with such accuracy that the flash of the gun may be reckoned upon as a thoroughly reliable means of testing the rates of chronometers, if a ship happens to be detained for a few days in the river.

The Mersey Docks and Harbour Board allow chronometers to be tested for thermal adjustment at the Bidston observatory, free of charge, under certain regulations. Persons taking them to be tested must be shipowners or masters of vessels paying dock dues, and they must be left for a period of not less than six weeks; if removed before no certificate of rate will be furnished.

Railway and steam communication.—All the principal railways are in immediate connection with the city of Liverpool, and have access to the various docks. A tunnel, under the Mersey from Liverpool to Birkenhead, for the purpose of connecting the railways on either side, was opened in January, 1886.

The Leeds and Liverpool canal has its terminus near Prince's dock, and is connected with Stanley dock. The Manchester ship canal, when completed, will enable vessels to proceed from the Mersey to Manchester. There is frequent communication by water, both for

passengers and goods traffic, with nearly every home, colonial, and foreign port of note in the world. Liverpool is the port of exchange for the manufactures of the surrounding districts and the produce of other nations ; that of the raw material—cotton especially—being the largest imported article.

Steam-ships sail direct to London and the chief intermediate ports ; to the Clyde, the Bristol channel, Dublin, and to most of the ports round Ireland.

Floating and other Nautical Institutions.—Near the custom-house is the Sailors' Home, which is capable of accommodating about 300 men ; and at the north end of the town is a branch home for 200 men. The ordinary city hospitals are available for sailors. Moored in the Sloyne are the following ships, which are lent by the Government for the undermentioned purposes :—

Conway, late *Nile*, a self-supporting school for educating the sons of gentlemen as officers of the Mercantile marine, off Rock Ferry.

Indefatigable, supported by voluntary contributions, for preparing the sons and orphans of sailors, and other poor and destitute boys, for service in the mercantile marine, off New Ferry.

Akbar (Protestant) and *Clarence* (Roman Catholic) reformatory ships, Government grant, off New Ferry.

For drill ship, lifeboats, &c., see page 343–344.

Trade.—The manufactures of Liverpool are chiefly connected with ships, their stores and machinery ; for which there are numerous building and repairing establishments, foundries, roperies and factories for steam engines. There are also sugar refineries, soap works, and flour mills.

The imports comprise the products of all parts of the world ; raw cotton, timber, flour, grain, petroleum and cattle from America ; hemp, tar, tallow, &c., from the Baltic ; and an immense amount of live stock and provisions from Ireland. The chief exports are cotton goods and woollens, manufactured articles of every description, salt in large quantities from the neighbouring mines, and coal.

The number of vessels which entered the port for the year ending 1st July, 1888, was 22,241, of the aggregate tonnage of 9,017,935.

The population of Liverpool in 1881 was 552,425. In 1831 it was 205,964.

BIRKENHEAD.—This populous town is situated upon the Cheshire shore directly opposite Liverpool. The shallow pool of Wallasey which formerly bounded it upon the north has been converted into extensive docks, named the East and West Floats,

which, with other docks and basins, have a water area of $164\frac{1}{2}$ acres; there are also three graving docks under the control of the Mersey Dock and Harbour Board as well as private docks. *See* p. 351. Shipbuilding in wood and iron embracing every class of vessel is carried on, on a large scale, and there are also several manufactories.

Population in 1881, 83,324.

On either side of Birkenhead along the shores are the populous towns and parishes of New Brighton, Liscard, Egremont, and Seacombe, upon the north side; and Tranmere, Bromborough, and Eastham on the south. There is direct railway communication with Chester, distant 15 miles, and places in the estuary of the Dee, *via* the Seacombe, Hoylake and Dee side Railway; and with Liverpool by the Mersey tunnel. Birkenhead is within the port of Liverpool, and the town is a borough with a mayor and corporation; indeed the whole district named may be considered a prosperous and healthy suburb of its important commercial neighbour.

UPPER MERSEY. — General remarks. — Depths. — Buoyage.—That portion of the estuary above Liverpool, and the upper Mersey are dry at low water, with the exception of the winding course of the river and deep water bights or blind channels, which are subject to constant change. There is, however, a considerable traffic by river craft and other small vessels between the docks at Liverpool and those in connection with the inland and canal navigation. The ports or places of communication, as far as Warrington, will be mentioned. Vessels up to 22 feet draught use the Garston docks at or near springs; those of 15 feet to Runcorn, Weston and Ellesmere; those of 11 feet to Widnes and West Bank dock; and those of 7 feet to Warrington. There is no traffic to Warrington during neaps.

The Upper Mersey commences just above Garston Docks.

The channel to Garston is buoyed by the London and North-Western Railway Company; a light ship and three buoys, from Otterpool leading to Upper Mersey, are provided by the Mersey Dock and Harbour Board, thence to Warrington the lights and buoys are under the control of the Upper Mersey Navigation Commissioners, and are moved when occasion requires. They are laid down upon the same system as that at Liverpool.

No directions would be of any service, because they could not be depended on for any length of time.

Those interested in the upper navigation have their offices in Liverpool, and provide pilots and steam tugs when required.

Channel to Eastham Ferry.—Above New Ferry, on the Cheshire shore, the low-water channel to Eastham is gradually reduced in breadth by the Eastham sand, which dries as much as 16 feet in places; the depths also are gradually reduced from about 6 fathoms off New Ferry to one fathom off Eastham. About midway is the space reserved for powder hulks, abreast the magazines.

Manchester Ship Canal, in course of construction, connects with the Upper Mersey just above Eastham. The entrance locks will be 80 feet, 50 feet and 30 feet wide respectively, with a depth on sill of 42 feet at high-water average springs, and 15 feet at low-water springs; at neaps 34 feet and 20 feet respectively. The canal will be 26 feet in depth and its bottom between Eastham and Runcorn will be 120 feet in width.

GARSTON.—**Wet docks.**—Garston is $4\frac{1}{2}$ miles above George's landing stage. There are two wet docks, one of 6 acres, entered by gates 50 feet wide, the sills having 25 feet water over them at high water springs, or 6 feet more than that of the Old dock at Liverpool; the other dock, which was opened in June 1875, has an area of 8 acres, the entrance is 55 feet wide, and the depth over the sills is 27 feet at springs: there is also a gridiron 300 feet in length. The docks are furnished with 28 hydraulic cranes, capable of lifting from 2 to 40 tons, and 8 high level coal tips. Garston docks are adapted for vessels of about 2,000 tons register, and they are the property of the London and North-Western Railway Company.

Off Dingle point, at the south extreme of the Liverpool docks, the channel to Garston is a quarter of a mile wide with a depth of 8 fathoms in mid-channel; this is reduced off Garston docks to a width of 150 yards, with a depth of 20 feet at low-water springs.

Signals.—At the dock entrances, a flag is hoisted by day and a *red* light by night when the docks are blocked; when clear, there is no flag, and a *white* light is shown. Garston is a creek of Liverpool. The population in 1881 was 10,131.

WEST BANK wet dock on the Lancashire shore, just below Runcorn bridge, is about 10 acres in extent, 35 feet wide in the entrance, with a depth on sill of 16 feet at high-water springs. *Red* lights are exhibited at night during tide time.

WIDNES is a little above Runcorn Gap, and $8\frac{3}{4}$ miles from Garston by the channel.

The **wet dock** belongs to the London and North-Western Railway Company, and is about $1\frac{1}{4}$ acres in extent, with an entrance

22 feet wide, and a depth at high-water springs of 12 feet. It is in connection with the Sankey canal, and the London and North-Western Railway, and is furnished with two steam cranes and five coal tips. The lower pond of the Sankey canal between the lock and iron swing bridge is also used as a dock for vessels not drawing more than $7\frac{1}{2}$ feet; it is furnished with four steam cranes. The locks are 78 feet long and $19\frac{1}{2}$ feet wide.

RUNCORN.—The Bridgewater docks, at Runcorn, are eight in number, comprising a water area of about 16 acres, with entrances from $21\frac{1}{2}$ to 50 feet wide, and depth of $18\frac{1}{4}$ feet over sills at high-water springs. There is also a gridiron 150 feet in length, and 40 feet in breadth. The docks are connected with an extensive inland navigation and railway system, and belong to the Manchester Ship Canal Company.

Vessels of 15 feet draught, of about 500 tons, can navigate to Runcorn at or near high-water springs; there is a depth of 3 feet water only in the river off Runcorn, at low-water springs.

Signals.—At tide-time during the day, a flag is hoisted at the signal-mast head when the entrance is clear; a flag half-mast high when there is no admission.

By night, when the entrance is clear, a *white* light is shown; when vessels must move slowly and cautiously, a *green* light is shown; when there is no admission, a *red* light is displayed.

Steam tugs.—The company have steam tugs which ply every tide between Liverpool and Runcorn; and vessels with cargoes for their docks, to be discharged by their men, are towed free of charge.

Runcorn is a custom-house port, the boundaries joining with those of Liverpool on both sides of the Mersey, and include Weaver docks at Weston point, Widnes, and Warrington.

The population in 1881 was 15,133.

WARRINGTON is a parliamentary borough situated upon the north side of the Mersey. The river here takes several sharp bends, and is crossed by one road, and three railway bridges, beyond which it is made navigable by weirs and locks, and unites with the Irwell navigation to Manchester, 20 miles. Vessels carrying from 80 to 150 tons get up to Bank quay at high-water springs. The town has several manufactories, and the population in 1881 was 41,456.

WESTON is upon the same or Cheshire side of the river, $1\frac{1}{4}$ miles below Runcorn Gap.

Wet docks.—The Weaver Navigation Trustees have here three docks in connection with the canal and river to the salt-works near

Northwich, $13\frac{1}{2}$ miles. The united extent of the dock accommodation is 4 acres, and they are entered by gates 50 feet wide, and having 19 feet over the sill at high-water springs.

When the gates are not open or navigation is obstructed, a ball is hoisted by day and a *red* light is shown at night.

ELLESMERE PORT is about $8\frac{1}{2}$ miles above Liverpool, on the Cheshire side of the Mersey. It belongs to the Shropshire Union Railways and Canal Company, and is the terminus of their canals.

The wet docks comprise about $3\frac{1}{2}$ acres with an entrance width of 33 feet, and a depth over the sill of 21 feet at high-water springs: the depth of water in the dock is 14 feet. There is a lock 105 feet in length, and 32 feet in width for coasting vessels, and another for smaller craft 75 feet in length, and $14\frac{2}{3}$ feet in width; also a patent slip for vessels of 300 tons.

The port is frequented chiefly by flats of from 80 to 150 tons burthen.

A *fixed white* light is shown while there is water of a depth of 7 feet on the sill of the locks.

Vessels bound for this port are towed free of charge on notice being given at the Company's offices at Liverpool.

Ellesmere port is a station of the Hooton and Helsby branch railway.

Tides.—On a rise of tide of 21 feet above the Old Dock sill, Liverpool (equal to a range of tide of nearly 30 feet, and $2\frac{1}{2}$ feet above the mean spring range), the surface level at Garston is about one foot above the high-water level, and at Warrington 4 feet; affording at Garston a rise of 32 feet: at Ellesmere port, 30 feet; at Weston point, 18 feet; at Runcorn gap, 16 feet; and at Warrington, 9 feet, or 16 feet above the Old Dock sill at Liverpool. The low-water level of a tide 10 feet below the Old Dock sill, the datum for the reduction of soundings on the charts of Liverpool, reaches to near Ellesmere, above which there is an incline of surface water depending on the amount of freshet in the river. A neap high-water, of 10 feet above the Old Dock sill, reaches to Fidlers ferry, about half-way between Runcorn gap and Warrington, affording a depth at the former place of 4 feet.

The duration of a spring flood is $2\frac{1}{2}$ hours at Runcorn, and 1h. 40m. at Warrington bridge.

CHAPTER XII.

FORMBY POINT TO ENTRANCE TO FIRTH OF SOLWAY.

VARIATION IN 1891.

Morecambe bay - - - - 19° 10' West.

COAST.—Low sand-hills form the coast from Formby point, the north extreme of the entrance to the Mersey, for a distance of 6 miles to Southport, south side of entrance to the Ribble. The foreshore is a continuation of the Mad-wharf sand, and has a low-water breadth of nearly one mile.*

RIBBLE RIVER is navigable at high-water springs to Preston, 10 miles above Lytham, and 15 miles from the sea, by vessels drawing 15 feet. Works are in progress, to be completed at an early date, to increase the depth in the channel to 29 feet, and there will be the same depth on the new dock sill at Preston. This will admit vessels of 22 to 24 feet reaching Preston at high-water springs. *See* p. 364.

The Ribble has its rise near Gearstones, in the West Riding of Yorkshire, at the east foot of Whernside, which is elevated 2,414 feet; it flows first southward to Settle, 12 miles, then south-westerly, entering Lancashire near Clitheroe, $22\frac{1}{2}$ miles, and arrives after many bends at the town of Preston, 57 miles from its source; its two chief tributaries being the Hodder from the north, and the Calder and Darwen from the south-east. Passing southward of Preston the river becomes navigable, and widens out into a broad estuary, the stream, however, being confined between stone embankments, 4 miles in length on the north side, and 10 miles on the south side, from the entrance to the Preston docks. On the northern shore are the villages of Freckleton, Lytham, and St. Anne's, while the opposite shore (equally low) is varied by those of Hesketh Bank, Crossens, North Meols or Churchtown, and the town of Southport. About 5 miles below Preston is the Douglas river, which connects the Ribble with the Leeds and Liverpool canal.

The estuary.—Between Stanner point and Southport the estuary of the Ribble is 5 miles wide, and sands, which are uncovered at

* *See* Admiralty chart, England, west coast, Formby point to Firth of Solway, No. 1826; scale, $m = 0.5$ inch. The directions from Formby point to Fleetwood are the result of a survey by Staff Commander W. E. Archdeacon, 1883 and 1889.

low water, extend out about $3\frac{1}{2}$ miles beyond that line, and across the mouth, between the village of Southshore and Ainsdale bank, for a distance of 10 miles. The principal of these are the Horse, Salt-house, and Crusader banks. The main channel of the Ribble is named the Gut.

LIGHTS.—At Stanner point, close to the beach, north side of entrance to the Ribble, is a stone tower, painted black, from which is exhibited, at an elevation of 81 feet, an *intermittent white* light showing for *three and half minutes*, and eclipsed *half a minute*; it is visible in clear weather from a distance of 12 miles.

A *fixed red* light is exhibited on Lytham pier, a *fixed white* light on Southport pier, and two *fixed red* lights on St. Annes pier, one at each end. See light buoys for Gut channel, below.

Tides.—It is high water, full and change, at the Ribble lighthouse, at 10h. 51m. local, 11h. 3m. Greenwich time; springs rise 24 feet, neaps 17 feet. At Preston it is high water at 11h. 49m. local time; springs rise 15 feet, and neaps 8 feet.* The time of high water at Lytham is three-quarters of an hour later than at the entrance. Southerly winds increase the rise of tide in the Ribble.

Pilots.—Vessels requiring pilots should make the signal when first coming in sight of Stanner point lighthouse, and the pilots will also go to any port to conduct vessels up the Ribble upon application to the harbour-master at Preston. There are two steam tugs available.

ENTRANCE CHANNELS.—The Gut, which is the principal entrance into the Ribble, is a narrow and tortuous channel between Horse and Salthouse banks, joining North channel about one mile below Lytham pier. Its bar, situated 6 miles below Lytham, had a depth of 4 feet (1889) at low-water equinoctial springs, but 2 miles within, the channel was just dry. Two pools, with from 7 to 9 feet, existed below Lytham. Above Lytham the channel is embanked, and works are in progress to improve it.

Buoyage.—**Light and bell buoys.**—A bell boat light buoy, painted red, named the *Nelson*, is placed in 7 fathoms, on the north side of the approach to the Gut channel, with Stanner point light bearing E. $\frac{1}{2}$ S. distant $6\frac{3}{4}$ miles, and Southport pier light S.E. $\frac{1}{2}$ S. The light is an *occulting white* light 23 feet above the sea, visible in clear weather from about 6 miles. Duration of flash four seconds, eclipse two seconds.

* The improvements in the river will probably alter the time and height slightly at Preston.

A bell boat light buoy, painted red and white, and lettered *Penfold buoy*, is moored in the Gut channel S.E. by E. $\frac{1}{2}$ E. $\frac{3}{4}$ miles from the before mentioned buoy, with Stanner point light N.E. $\frac{1}{2}$ E. $2\frac{1}{10}$ miles. From it is exhibited a *fixed white* light, 23 feet above the sea, visible about 6 miles.

A spherical buoy, painted red, and lettered *Ansdell*, surmounted by a *fixed red* light, 12 feet above the sea, is placed N.E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles from the last-mentioned buoy, nearly in the direction of Stanner point light, and is visible about 5 miles.

Buoys.—A black conical buoy, with staff and ball, in 4 fathoms, marked "No. 1 G.," is placed on the south side of the approach to Gut channel, with the Nelson or outer bell light buoy bearing N.W. $\frac{1}{2}$ W. about $2\frac{1}{4}$ miles.

The entrance to the Gut is marked by two buoys on each side; the outer one on south side being nearly a mile E.N.E. of No. 1 G.; within these four buoys, the channel is from buoy to buoy. The buoys are painted black, each surmounted by a staff and ball, and numbered from seaward.

The positions of the bouys are altered to meet any changes in the channel.

Directions.—There are no dangers in the approach to the outer bell boat light buoy, which lies in 7 fathoms; thence the course is about E.S.E. between the entrance buoys, and to the Penfold bell boat light buoy; thence to the Ansdell light buoy and the buoys within it. The Gut should not be taken without a pilot, but in case of necessity, steer from buoy to buoy, and anchor on the flat above Lytham. Depths to Preston, *see* p. 364.

North channel, between Salthouse and Crusader banks, has two entrances; Nix Hollow, the southern one, runs close along Salthouse bank, and is not buoyed.

The bar of the northern entrance, across Crusader bank, dries about one foot at low-water springs; the channel also dries above St. Anne's pier, but just northward of the pier there is a pool with 10 feet water; the centre of the channel is marked by red conical buoys numbered from seaward. It is reported to be filling up, and should not be taken without a pilot.

SOUTHPORT APPROACH.—**South channel** of the Ribble is the approach to Southport; its bar, situated 4 miles westward of the Southport pier, has a depth of 4 feet at low-water equinoctial springs, within which, the water deepens gradually to 5 and 7 fathoms off pier.

Buoyage.—South channel is marked by black conical buoys on the starboard hand, on entering, and red can buoys on the port.

The outer buoy, black, a cone buoy with staff and cross, in 2 fathoms, lies just south of the leading mark, distant $4\frac{1}{2}$ miles from the pier. The next black buoy is conical, with staff and globe, marked S. 1; the four black buoys within are numbered S. 2 to S. 5 in white letters. The outer red buoy, can, with staff and cage, numbered S. 1, lies $\frac{2}{3}$ ths of a mile within the outer black buoy. The four red can buoys within it are marked S. 2 to S. 5 in white letters.

Directions.—To proceed to the anchorage off Southport.—Having approached the outer black buoy, with staff and cross, steer in northward of it, with the spire of Christ Church on with the north-west end of the winter garden, bearing E. $\frac{1}{4}$ N.; thence between the black buoys on the starboard hand and red buoys on the port hand to the pier head, passing close to it, and anchor in Bog Hole. To proceed above the anchorage a pilot is necessary.

There is a somewhat deeper channel, known as Half-tide channel, at one mile northward of South channel, but it is not buoyed. The leading mark is St. James' church in line with Sand patch, bearing S.E. by E. $\frac{1}{2}$ E.

Anchorage.—Safe anchorage may be had in Bog Hole, above Southport pier, in 5 to 7 fathoms at low-water, with the pier-head bearing about S.S.W., distant one to two cables; the space being limited, it is advisable to moor.

SOUTHPORT is a much frequented watering-place, stretching for about 2 miles along the shore, and fronted by a promenade and sea-wall; its well-built houses and public buildings form a conspicuous feature from the sea. It has a town hall, a convalescent hospital, a free library and art gallery, and some good hotels; also winter gardens and an aquarium situated at the west end of the town. The district at the back of Southport was formerly a wide marsh, known as Marton Mere; this has been successfully drained, and is now most productive. The town is connected by railway with Liverpool, &c. The population in 1881 was 32,191.

Pier and Light.—From off nearly the centre of the town a pier upon iron piles projects for 1,450 yards in a N.W. by N. direction, at the head of which is exhibited a *fixed white* light. There is apparently a depth at its extreme of about 6 fathoms at low water.

Supplies of all kinds may be obtained at Southport; water is delivered from a pipe at the pier-end; and a lighter, with from 60 to 80 tons of coal on board, is always ready to supply vessels calling in.

Lifeboat.—A lifeboat is stationed at Southport.

LYTHAM is a watering-place 10 miles by the river below Preston ; it has a railway to Blackpool, $7\frac{1}{2}$ miles, and a branch to the line between Preston and Fleetwood ; steamers also in summer run between it and Southport, but craft remaining here have to lie aground.

There is a pier upon iron piles, running out 900 feet to the low-water margin. Lytham is a creek of the port of Preston. The population, many of whom are employed in the fisheries, was, in 1881, 4,122.

St Anne's is a rising watering-place situated a short distance north-westward of the Ribble lighthouse. An iron pile pier extends out from abreast the coastguard station to low-water margin.

Lights.—A *fixed red* light is exhibited from the outer end of the pier at Lytham, and a *fixed red* light at each end of the pier at St. Anne's, as before stated.

Supplies.—The usual supplies are obtainable at Lytham.

Lifeboats are stationed at Lytham and St. Anne's.

Anchorage.—Small craft find temporary anchorage in the pool, with from 7 to 10 feet at low water, situated just below St. Anne's pier ; the holding ground is loose gravel, and unsafe ; a considerable sea, depending on the wind, tumbles in as soon as the banks are covered.

PRESTON is a parliamentary borough of ancient date, and a very important cotton manufacturing town of Lancashire ; it is also the nearest port to the great coalfields in the Wigan and Yorkshire districts, and an important seat of iron and machinery industry. The town is finely situated, and the river, winding round two sides of it, is crossed by several road and railway bridges. The commerce of the port, which includes Freckleton, Lytham, and Hesketh, is considerable, and shipbuilding in wood and iron is carried on.

The custom-house returns in 1889 were as follows :—The number of vessels belonging to the port, 59, amounting to 3,625 tons. Coasters, inwards, 287 = 23,263 tons ; outwards, 294 = 24,645 tons ; foreign, inwards, 6 = 866 tons.

The population in 1881 was 96,532.

Depths to Preston.—As before stated, the river above Lytham is embanked ; training walls and other works are in progress (which it is anticipated will be completed in 1891) to admit vessels of 22 to 24 feet draught reaching Preston docks at high-water springs.

Quays and docks.—At Preston there is a quay 500 yards in length, constructed on a diversion of the river ; it is fitted with coal

tips, steam and other cranes, and is in connection with the Lancashire and Yorkshire railway. There is a patent slip adapted for vessels of 260 tons, and a gridiron 120 feet in length; there is also a patent slip at Freckleton, 6 miles below, available for vessels of 14 feet draught at spring tides.

The corporation are constructing a wet dock of 40 acres, with locks, and a tidal basin of $4\frac{3}{4}$ acres. There will be a depth of 29 feet over the dock sill at high-water springs.

It is also contemplated to construct a graving dock, and a timber pond of about 15 acres.

Lights.—On the dock pier head at Preston a *fixed red* light is exhibited. *Fixed white* lights are exhibited on the embankment every half mile down the river on alternate sides, as far as Douglas river. Lower down, *fixed white* lights are exhibited on south side, every mile, to the end of the Clay bank opposite Ansdell, 11 miles below the dock entrance. A *fixed red* light is exhibited at Bank Nook perch, north side, opposite Warton. These lights are exhibited all night.

Dredging buoys.—A red buoy marks the dredging deposits at the end of the Clay bank, and four buoys, painted red, mark the dredging depositing ground in the vicinity of Penfold buoy, p. 362.

Directions.—See p. 362. Pilots, see p. 361.

Supplies of all description are obtainable at Preston.

BLACKPOOL.—The coast is low and sandy from the Ribble to Southshore village, but rises at Blackpool; both these places are bathing stations, and contain a superior class of houses, generally facing the sea. Each has a church; that at Blackpool is the larger, and, being upon higher ground, is conspicuous; the glass dome of the winter gardens, and the hotels and large houses built on the highest part of the cliff at north end of Blackpool, are also conspicuous from seaward.

Piers and lights.—From abreast Blackpool church an iron pile pier projects in a western direction for 1,650 feet, including a landing-stage of 300 feet; at the head there is a depth of 22 feet at springs, and from it a *fixed green* light is shown all night. Half a mile farther south is a similar pier of 1,400 feet in length, from the head of which a *fixed red* light is exhibited all night.

During summer steamers ply to Southport, Piel, &c., and there is railway communication to Lytham, and by a branch to Poulton-on-Wyre. The population of Blackpool in 1881 was 14,448.

Lifeboat.—A lifeboat is stationed at Blackpool.

The country, though for the most part flat, is relieved by gentle and well-cultivated eminences, over which villages and farmsteads are interspersed. The coast line declines in height from Blackpool to Rossall point, the red clay cliffs being succeeded by a sandy bank abreast Bispham.

MORECAMBE BAY.*—Morecambe bay, an extensive inlet of the Lancashire coast, is 9 miles wide at its entrance between Rossall point and Walney island, and 14 miles deep to the entrance of the river Kent. Rossall point is distinguished by a beacon of wood 57 feet high.

At low-water four-fifths of this indenture is occupied by dry sand, which is intersected by the various channels representing the outfalls of the rivers Wyre, Lune, Kent, and Leven. Instead of describing the bay and its dangers as a whole, it will be more convenient to notice in order the several ports within its boundaries, all of which are tidal, with the sands, &c., in the approach to them.

LIGHT-VESSEL.—A light-vessel is moored in 12 fathoms, with Wyre lighthouse bearing E. by S., distant about 18 miles, and Walney light E. by N. $\frac{1}{4}$ N.; her hull is painted red, with "Morecambe bay" on her sides, and she carries one mast surmounted by a red ball. From a lantern elevated 38 feet, is exhibited a *red* light which *revolves every thirty seconds*, and is visible in clear weather at a distance of 11 miles.

A watch buoy, red, can, is moored near the light-vessel.

Fog signal.—During thick or foggy weather a fog siren is sounded, giving *three blasts* in quick succession (two low notes and a high note) *every two minutes*.

Anchorage.—The best open anchorage in Morecambe bay is undoubtedly Heysham lake, for the peculiar formation of the banks there shuts out much of the tide from half-ebb to half-flood, and near low water the stream is almost slack. In consequence of this peculiarity, during south-westerly gales, when the ebb stream is running out against the swell, and throwing up a dangerous breaking sea in other parts of the bay, there is comparatively smooth water, such as any well-found ship could ride in comfortably; moreover, there is plenty of room in Heysham lake (page 376), and it is so easy of access that a pilot is not required.

Anchor near mid-channel well within the entrance of the lake in 6 to 10 fathoms at low water, or eastward of the line of Rossall

* See Admiralty chart, England, west coast, Formby point to the Firth of Solway, No. 1,826, scale, $m = 0.5$ inch; and Morecambe bay, No. 2,010, scale, $m = 2.2$ inches.

beacon and Wyre lighthouse. *See* directions for approaching Fleetwood, which apply to this anchorage, p. 370.

In Grange channel good anchorage may be obtained, in 3 to 7 fathoms, within the light-vessel; but the bar, with depths of about 15 feet at low water, and which is constantly altering, has to be first crossed. There would be no object in seeking this anchorage unless bound to Morecambe, for which the services of a pilot are necessary.

APPROACHES to FLEETWOOD.—**LUNE DEEP**, the main channel into Morecambe bay, is a deep hollow between the dangers off Rossall point and Fisher bank and patches; while the shoals bounding it have only from 3 to 6 feet upon them, their edges dip suddenly so as to increase the depth to 23 and 25 fathoms, and in one place near its west extreme it is 32 fathoms deep. The channel at its narrowest part is one mile wide; it extends 8 miles to the westward, and one mile to the eastward of the Wyre pile lighthouse, whence eastward it divides, and is known as Lancaster sound and Heysham lake.

There is good anchorage anywhere eastward of King scar for all classes of vessels. *See* Directions, p. 370.

Sands and Buoyage.—The following dangers lie in the approach to Fleetwood bordering the Lune deep:—

Shell flats and Oyster grounds.—Shallow ground extends seaward for the whole distance between the Ribble and the Wyre; as far northward as Blackpool a depth of 5 fathoms will be found at $2\frac{1}{2}$ miles off-shore; but between it and the Wyre, abreast Bispham, a depth of $2\frac{1}{2}$ to 3 fathoms will be found between $2\frac{1}{2}$ and 5 miles off, known as Shell flat, whence it gradually deepens to 5 fathoms at 11 miles off shore.

The inner part of the flat towards Rossall point, different portions of which are known as Rossall oyster grounds, Rossall patches, and Boulder banks, is shallow. The northern part of the flat, which is steep, and dangerous from the shallow stony patches lying along it, forms the southern boundary of Lune deep. These patches extend 8 miles westward of King scar, terminating just westward of North-west boulder.

A rock with a depth of 6 feet lies with Preesall mill in line with Rossall landmark, bearing S.E. by E. $\frac{1}{2}$ E., distant from the latter $2\frac{1}{4}$ miles. Foul ground, with less than 3 fathoms, extends 2 cables north and 7 cables westward of this patch.

Clearing marks.—Yarlside church tower in line with the red light post on the east extreme of Walney island leads westward of

Rossall patches and of Shell flat, in not less than 3 fathoms. Wyre lighthouse bearing southward of East, leads northward of Rossall patches and North-west boulders.

Buoy.—A red buoy with a square cage, marked Shell wharf, lies in 38 feet at low-water, $1\frac{1}{4}$ miles westward of the North-west boulders, with Rossall beacon bearing E. by S. $\frac{1}{2}$ S., distant $3\frac{1}{10}$ miles.

Danger patch.—Morecambe flats, extending from the body of the sands in the bay, form the northern boundary of Lune deep. The southern edge of the flat is shallow, but steep-to, the inner and shoalest portions being named Fisher bank and scars, which are awash in places at low-water springs; while farther out are Fisher bank spit and patches, one of the latter, named Danger patch, having on its southern margin a rock with only 5 feet at low-water springs. From this rock, Preesall mill is open a little southward of the high light at Fleetwood and of King scar beacon, distant from the latter $1\frac{3}{4}$ miles.

Preesall mill in line with Fleetwood church spire, bearing S.E. $\frac{1}{4}$ E., leads westward of Danger patch and the patches westward of it in not less than 4 fathoms.

Buoy.—A vertically-striped black and white can buoy, with staff and cage, is moored in 3 fathoms, about 2 cables westward of Danger rock.

North Wharf flat.—Beacons.—North Wharf is the name of the sandflat dry at low-water, extending $1\frac{3}{4}$ miles northward of Rossall and Fleetwood; its eastern side forms the west side of the channel of the Wyre to Fleetwood. The highest part, eastward of King scar, dries about 16 feet at low-water springs. The north-east corner of the flat is marked by the pile lighthouse; a black perch, with a platform 33 feet above high water, stands $1\frac{1}{10}$ miles W. by S. of the lighthouse, just within King scar.

King scar, the north-west portion of North wharf flat, is a rocky bank nearly half a mile in diameter, the highest part of which is dry at half-tide; a red conical buoy, in about 3 fathoms, is placed one cable north-west of the west extreme of the scar.

Bernard Wharf flat is the eastern boundary of the channel leading from Lune deep to Fleetwood. It dries out at low-water for $2\frac{1}{2}$ miles from the main, and occupies the whole of the space between the channels of the Wyre and the Lune.

FLEETWOOD.—River Wyre, which discharges itself on the south side of Morecambe bay, has its source on the moorland borders of the West Riding of Yorkshire. Near Garstang church, $16\frac{1}{2}$ miles from its source, it receives the Calder, and 7 miles beyond reaches Cartford bridge, where the river expands, and below the town of Poulton-le-Fylde has a broad estuary, named Wyre water; the sea outlet is a narrow channel by the town of Fleetwood, which is situated upon the western point 9 miles from Cartford bridge, or 32 miles from the source of the river.

Bar.—There is a depth of 9 feet at low-water springs on the bar, 2 miles below Fleetwood, 29 feet at high-water neaps, and 36 feet at high-water springs, with 3 feet more water to the town. See p. 371 for depth to quays.

LIGHTS.—Wyre Lighthouse is painted red, and is upon screw piles at the north-east elbow of North-wharf bank, at the junction of Wyre outfall with Lune deep, with Fleetwood light-houses bearing S. $\frac{3}{4}$ E., distant $1\frac{3}{4}$ miles; it shows a *fixed white* light, 30 feet above high-water, and is visible at the distance of 10 miles in clear weather.

A *red* sector of light is shown from the balcony of the pile-light, over the fairway buoy, when the mail steamer from Ireland is expected.

Fog signal.—A bell is sounded at the lighthouse in foggy or snowy weather, *three strokes per minute*, with an interval of *one minute*.

Signals are also made by the light-keeper in case of vessels being observed in distress, or requiring pilots.

Fleetwood Tidal Lights.—Signals.—There are two light-houses at Fleetwood; the higher one, of stone colour, with a red lantern, being in the town, and the lower, of stone, on the shore margin of the esplanade; they bear from each other N. $\frac{1}{4}$ W. and S. $\frac{1}{4}$ E., and are 283 yards apart. The lights are respectively 90 and 30 feet above high water; both are *fixed white* lights, and they are shown while there is a depth of 12 feet over the bar, which means 15 feet within it. A black ball is shown by day from the lower lighthouse, and also at the Wyre lighthouse, to indicate the same depth of water. A *fixed* light is also shown from the red perch on the east extreme of Black scar. It shows *white* in the channel from seaward until abreast Bell perch, within which it shows *red*.

Buoyage.—The channel to Fleetwood is marked by red conical buoys on the starboard hand, on entering, and by black can buoys on the port hand:—

The fairway buoy, black, lies in 8 fathoms, with the pile lighthouse bearing S.S.E. distant half a mile.

At the north-east corner of North Wharf flat is the pile lighthouse before mentioned, and a red conical buoy.

The North Wharf flat, above the Wyre lighthouse, known as Great Ford and Black scar, is marked by red conical buoys; and a bell perch marks the north-east extreme of Black scar.

The west side of Bernard Wharf, east side of channel, is marked by black can buoys.

Tides.—At Wyre pile lighthouse, it is high-water, full and change, at 11h. 11m. local, 11h. 23m. Greenwich time; springs rise $27\frac{1}{2}$ feet, neaps $20\frac{1}{2}$ feet, and neaps range 15 feet. At Fleetwood, high-water occurs at the same time, with 6 inches less rise. In the Wyre channel, the first half of the flood sets to the southward or into the Wyre; during the latter half of the tide, when the sands are covered, the set is to the eastward. The set of the first half of the ebb is to the westward; afterwards it runs to the northward or out of the Wyre. In Lune deep the streams run at the rate of $3\frac{1}{2}$ to 4 knots at springs.

Pilots.—Three of the six licensed pilots for Lune deep, and the ports within it, cruise at sea in a cutter of 25 tons, with the letter F on her mainsail. She cruises between Formby point and Duddon river, and as far to the westward as Morecambe bay light-vessel, according to the prevailing wind. There are several steam-tugs belonging to Fleetwood.

DIRECTIONS.—**Lune Deep and Fleetwood.**—The services of a pilot are necessary if it is intended to enter either of the ports, but little difficulty would be experienced in taking up an anchorage off Fleetwood, or above in Heysham lake, as mentioned, p. 366.

In misty weather, and with the marks indistinct, remember that to the southward of Lune deep the bottom is in general white sand, and that to the northward dark sand prevails, though too much dependence must not be placed on it. A low-water depth of 8 fathoms will keep a vessel clear of all danger.

Approaching from the southward, Yarlside church in line or open westward of the red light post on east extreme of Walney island, leads westward of Shell flat in not less than 3 fathoms; and from the northward, Freesall mill in line with, or open southward of Fleetwood church, leads in southward of Danger and Fisher bank patches in not less than 4 fathoms.

The leading mark up Lune deep is the tower of St. Mary's church at Lancaster open northward of Middleton tower, bearing E. by N., but it is an indistinct mark; this mark leads northward of Shell flat

and King scar buoys to the entrance of the Wyre and Lune rivers ; the buoys, however, should afford sufficient guide.

Fleetwood.—If having to wait for the tide to enter Fleetwood, anchor to the north-westward of the lighthouse, or near the fairway buoy, in about 4 fathoms at low-water. The most dangerous winds for the Wyre bar are those from between N.W. and N.E.

Black balls are shown by day from the Wyre and Fleetwood light-houses, and Fleetwood lights are exhibited at night, while there is a depth of 12 feet on the bar. To enter the Wyre, having passed on either side of the fairway (can black buoy), keep the red conical buoys and beacons on the starboard hand, and the black can buoys on the port hand. The leading mark between them is, Fleetwood light-houses in line, bearing S. $\frac{1}{2}$ E., until above the Bell perch on Black scar, whence keep in mid-channel between the buoys, skirting the beach under the low lighthouse, and be ready to let go an anchor directly the harbour opens. Keep to the westward of the red mooring buoys lying in the stream.

At night, strangers should employ a pilot. To enter, steer for Wyre light, bearing E. by S., until about 2 miles from it, when steer E. $\frac{1}{2}$ N., avoiding King scar, for the fairway buoy ; Fleetwood lights, during tide time, will be seen from abreast King scar. From off the fairway, steer in with the high light just open, eastward of the low light S. $\frac{1}{2}$ E., until abreast the pile lighthouse, when keep them in line, until abreast the Bell perch, when bring the high light a little open westward of the low light to pass eastward of the light (showing *white*) on Black scar perch within it, thence for the two *red* lights on the quay wall in line, with the perch light astern (showing *red*), and follow the wall round to the harbour.

Fleetwood town owes its existence to the spirit and enterprise of the owner of the soil, Sir Peter Hesketh Fleetwood, who, in 1835. projected a railway from Preston to the mouth of the Wyre in order to the establishment of a port and the development of trade, at a time when railway communication was enjoyed by only a few of the largest towns in the kingdom. Concurrently with this improvement, the new town of Fleetwood had been rising into notice ; the harbour was deepened, beaconed, and lighted, and landing-stages and a pier were constructed.

Population in 1881 was 6,733.

Depths to quays.—There is a depth of 12 to 16 feet off Fleetwood at low-water springs, but vessels usually dock ; the approach is over the bar of the Wyre, 2 miles below Fleetwood, which has depths as stated on p. 369.

Fleetwood is skirted by about 900 yards of quayage, furnished with steam cranes, with a low water depth of about 6 feet at the extension; there are screw moorings in the harbour, sufficient for six vessels moored head and stern. A large grain elevator, 120 feet in height, forms one of the most conspicuous objects from the offing.

Docks.—The wet dock is 1,000 feet in length by 400 feet in breadth, and has an area of 10 acres; the lock entrance is 250 feet long, 50 feet wide, with 25 feet water over the sill at springs, and 22 feet in the dock; there is also a timber dock of 15 acres with 4 feet least water. There is a gridiron, 310 feet long and 50 feet wide, with a depth of $15\frac{1}{2}$ feet at high-water springs. Also a crane capable of lifting 50 tons, and many hydraulic cranes on the quays. The approach to the wet dock is between the gray walls of the town on the starboard hand, and spar buoys and lights on the port hand.

Dock signals.—A red flag on the topmast of the dock flag-staff indicates that vessels must not approach the dock; a corresponding red flag will also be hoisted on the east side of the high lighthouse.

A blue flag is hoisted half-way up the gaff at the dock when docking is about to take place; and it is shown at the head of the gaff when the gates are open.

Trade.—Fleetwood is connected to Preston by a railway, 20 miles in length; there are also, daily, steamers from and to Belfast, distant 120 miles, Sunday excepted. The principal foreign imports are cotton and Spanish ore; and pig iron, iron ore, and china-clay, coastwise. Coal and manufactured goods are exported.

The population in 1881 was 6,513. The coasting trade amounts to about 700,000 tons. The fishing vessels belonging to the port draw from 9 to 11 feet; they cruise in the Irish channel from Holyhead to Ailsa Craig, but the general fishing ground is 15 miles westward of Fleetwood.

Supplies.—Water is obtained alongside the quay, from the town mains.

Lifeboat.—A lifeboat is stationed at Fleetwood, and a rocket apparatus at the coast-guard station.

RIVER LUNE has its rise near Ravenstonedale below Langdale Fell, which is elevated 2,220 feet above mean tide level, and east of the market town of Orton in Westmorland. From thence it flows in a southerly and south-western direction, passing about 2 miles west

of Sedbergh and on to Kirby Lonsdale and Lancaster, 28 and 45 miles from the source; its chief tributaries being the Rawther, near Sedbergh, the Greta and Wenning, all from the eastward.

The Lune forms the port of Lancaster, which town is on the left bank, and beautifully situated on the sides of a hill crowned by a fine church, and the modern buildings of the castle, which are prominent objects from the entrance of the bay. From Lancaster the river expands into a winding estuary, in which is Glasson dock, issuing into Morecambe bay between Sunderland and Cockersand points, 7 miles below the town; and then, confined between sands which dry at low-water, the stream of the Lune, $4\frac{1}{2}$ miles lower down, effects a junction with Lancaster sound and Lune deep.

Depths.—The mouth of the Lune has a depth of about 3 feet at low-water springs, 30 feet at high-water springs; and 23 feet at high-water neaps; these depths are reduced within Sunderland hole, but there is always more water in the river below the dock, than there is on Glasson dock sill.

On Glasson dock sill, about 6 miles up, there is a depth of 20 feet at high-water springs, and 13 feet at high-water neaps. At Lancaster, abreast the quays, there is a depth of 13 feet at high-water springs, and 6 feet at high-water neaps, with no better water as far down as Snatchems, 2 miles below. The bed of the river is dry at low-water springs at both places, and is subject to considerable change throughout.

Tidal Lights.—Lune lighthouses stand, one on Cockersand promontory, and the other, named the Abbey, on Plover scar, at the junction of the estuary with Morecambe bay; they are E. by S. $\frac{1}{4}$ S. and W. by N. $\frac{1}{4}$ N., 834 yards from each other.

The upper light is in a wooden structure, 54 feet above high-water; the lower light is in a stone tower, and is 20 feet above high-water; the lights are *fixed white*, and are shown while there is a depth of 8 feet water in the channel. These are visible in clear weather about 7 miles, or from about abreast King scar buoy.

Tides.—It is high water, full and change, at Glasson dock, at 11h. 16m. local, 11h. 27m. Greenwich time; springs rise 20 feet, and neaps 14 feet. At Lancaster, it is high-water at 11h. 16m. local time; springs rise $8\frac{1}{2}$ feet, and neaps 2 feet. The duration of the flood stream is about two hours, and a high spring tide flows over the weir at Skerton. The tidal streams in the entrance to the Lune, and in Sunderland pool, run with a velocity of 5 knots at springs.

Sands and buoyage.—The outfall of the Lune is between Bernard Wharf, Preesall, Pilling and Cockerham sands on the south, and Sunderland Shoulder on the north. These, shelving from the shore, all dry at low-water, and, collectively, form one broad foreshore through which the river winds in many shallow and irregular channels.

The deepest water in the channel of the Lune to Sunderland hole is marked by black buoys, numbered from seaward. No. 1, the north-west buoy, just northward of the fairway, is a conical black buoy, with a white end or cap, lying in $7\frac{1}{2}$ fathoms, at the junction of Lune deep, E. by N. $\frac{1}{2}$ N., distant $1\frac{1}{4}$ miles from the fairway buoy of the Wyre.

Nos. 2 to 6 are black can buoys, but No. 4 is distinguished by a staff and ball. A conical black buoy, named Baithaven, marks the east edge of Sunderland spit, and a red perch marks Crook scar, off Chapel point, between which and Glasson dock are two black conical buoys marking some scars westward of Bazel point, port side on entering; the channel is between them and Little Narles rocks. A buoy and a few perches mark a portion of the channel to Lancaster, only available with local knowledge.

Abbey hole, just below Sunderland point and hole, is the only place within the sands barring the entrance to the river Lune where a vessel of 10 feet draught can lie afloat at low-water; and this anchorage is dangerous, especially near spring tides, from the strength of the stream as well as the loose yielding nature of the bottom, which is mostly fine sand.

Directions.—The buoys in the Lune are kept as near the centre of the fairway as possible, but on account of the shifting nature of the sands, it is not at all times, possible to accomplish. Strangers, therefore, should not attempt the navigation of the Lune above No. 2 buoy at night time, or in thick weather, without the assistance of a pilot. There is always deeper water in the Lune than there is on Glasson dock sill. The depth on the sill is shown by a corresponding gauge on Plover scar lighthouse.

Being in Lune deep with the fairway mark from sea on, namely, St. Mary's church opening northward of Middleton tower, continue on that line until near No. 1 buoy of the Lune; then with the Lune lighthouses in line, pass southward of that buoy, anchoring between it and No. 2., in from 4 to 7 fathoms, if there is not sufficient water to proceed into the river. If tide permits, then continue on from buoy to buoy; pass within half a cable northward of Plover scar

light, eastward of Baithaven buoy, and westward of Crook perch. Here a pilot should be obtained, or failing that, anchor between Crook perch and the houses on Sunderland point, until one arrives.

From the entrance, the strong set of the flood south-eastward towards Cocker, and in Sunderland hole towards Crook spit, must be guarded against. Vessels, should, however, if practicable, avoid the necessity of stopping here or elsewhere in the Lune below Glasson dock; near the entrance of the dock, there is a strong pile staging for securing vessels to, and where they may take the ground safely in an upright position.

By night.—Vessels should not proceed above No. 2 buoy without a pilot.

Glasson Wet dock, $1\frac{1}{2}$ miles above Sunderland Hole, is in connection with the basin of Lancaster canal. The dock is 500 feet in length, by 200 feet in width, having entrance gates of 35 feet, with a depth over the sill at ordinary springs of about 20 feet, and at neaps 14 feet. The lock connecting it with the canal basin is 100 feet long and 26 feet wide. The wet dock is fitted with steam cranes, and other appliances for the loading and discharging of vessels, and for coaling.

There is also a graving dock with a length over all, of 197 feet, length on blocks, 184 feet, width of entrance, 35 feet, and depth on sill, 12 feet at high-water springs. There is a blacksmiths' shop in connection with it.

Vessels of about 250 tons can lie alongside the wharf in the river, but it dries at low-water. A counter stream sets across the mouth of the lock during the last two hours of the flood, necessitating caution in handling vessels about to enter the dock.

Tidal Light.—A *fixed white* light is exhibited when the dock gates are open, from the lighthouse on the east pier of lock entrance.

The trade is principally coasting, with an import of timber from the Baltic, and America. Glasson dock is a creek of Lancaster custom-house. Population 1881 was 876.

LANCASTER.—This ancient borough, county town, and port, is situated on a rising ground upon the south bank of the Lune. Owing to the increase of traffic at Lancaster, the Commissioners have rebuilt and extended the quay, which is now about 500 feet in length.

Vessels of 12 feet draught navigate to Lancaster at high-water ordinary springs; (that is, when there is 20 feet of water on Glasson dock;) at neaps there is about 6 feet at high-water in the channel off Lancaster, and for about two miles below, as stated on p. 373. Vessels lie aground at the quays.

The river a little above the town is crossed by a stone bridge of five arches to the suburb village of Skerton, and one mile farther up by a magnificent aqueduct of five semi-circular arches, 70 feet span, and 51 feet high, which conveys over the Lancaster canal. Below the bridge there are two viaducts, one for the railway to Carlisle, the other to Poulton. Lancaster is also connected by the North-Western railway to Leeds and Preston.

There are both silk and cotton manufactories, foundries, and ship-building to a small extent. A few small vessels are engaged in the coasting trade. The number of vessels which entered the port in 1888, chiefly to Glasson dock, were 219, of the aggregate registered tonnage of 25,881 tons. The Lancaster Infirmary receives seamen requiring medical treatment. The population in 1881 was 20,724.

HEYSHAM LAKE is a deep channel between the sand-banks named Sunderland Shoulder and Clark Wharf, the entrance to which lies off the entrance to the river Lune ; a narrow gutter, with a depth of 2 feet between the Scars at low-water springs, connects its north-eastern end with Grange channel, forming the southern channel to Morecambe when the tide permits, to those acquainted with it ; the channel is not buoyed. For anchorage here, *see* p. 366.

MORECAMBE APPROACH.—**Depths.**—Grange channel, the buoyed channel leading to Morecambe, is about 5 miles in length ; its south-west end, 7 miles below Morecambe, has a bar usually with about 15 feet (1890) at low-water, but the whole is subject to considerable alteration ; vessels are recommended to take a pilot.

The channel deepens and widens within the bar, affording anchorage in from 3 to 7 fathoms at low-water springs ; but from its upper end, to Morecambe, distance $1\frac{1}{2}$ miles, the channel is dry in places at low-water springs. Off Morecambe there is a pool with 3 to 4 feet water ; the spring rise is 27 feet.

Grange channel lies between Clark Wharf sand and spit on the south-east, and Yeoman spit and wharf to the north-west. The highest part of the former sand near its north-eastern end dries 10 feet, the eastern portion of Yeoman Wharf dries 9 feet, and the western part about the same.

LIGHT-VESSEL.—A light-vessel is moored in Grange channel, northward of Clark Wharf, and on north side of the channel entrance, in about 13 feet. She is painted red, with "Morecambe" in white letters on her sides, carries one mast surmounted by a ball, and exhibits, from an elevation of 30 feet, a *fixed red* light, which is visible at the distance of 5 miles. The vessel (1890) lies with Wyre

lighthouse bearing S.W. $\frac{1}{2}$ S. distant $4\frac{3}{10}$ miles, and Walney lighthouse N.W. by W. Her position is subject to alteration.

Tidal light and signal.—Also, while there is not less than 8 feet depth in the channel over Inner bar leading to Morecambe harbour, a *fixed white* light, in addition, is shown at the bow by night, and a black ball is hoisted on a flagstaff by day.

Fog signal.—In thick or foggy weather or snow, a bell is sounded *every twenty seconds*.

Buoyage.—Grange channel is marked by red conical buoys on the starboard hand, on entering, and black conical buoys on the port hand; No. 3, red, is a bell buoy, and between it and No. 2, red, is a red pillar buoy.

Inner bar.—The shoalest spot between the sea and Morecambe is northward of Old scar, on which there is a beacon. Here, between No. 5 red, and No. 3 black buoys, half a mile below the town, it is dry at low-water springs. The buoyage is altered to suit the changes in the channel.

Morecambe harbour, situated on the south-east side of Morecambe bay, is just dry at its entrance at low-water springs, as is the sand bar half a mile below it; but it affords depths of 20 feet at high-water neaps, and 27 feet at high-water springs.

There is about 3 feet in the pool of the river abreast the harbour at low water.

The harbour is formed by the projection of two piers in a northerly direction for 1,000 feet, and 400 feet apart, over Ring scar. The western pier is of stone, the other on wood piles. There is also a handsome iron pile promenade pier, 900 feet in length, at the distance of one-third of a mile to the eastward of the harbour, springing from near the centre of the esplanade fronting the town. The ends of these piers are barely dry at low-water springs, but all access to this part from the sea at such times is cut off by the Inner bar above mentioned.

The sands encumbering the approach to this harbour are continually shifting, and the Midland Railway Company, to whom it belongs, regulate the buoyage accordingly.

LIGHTS.—A *fixed white* light is shown from the extremity of the western or stone pier at Morecambe, at an elevation of 48 feet above high water, and is visible at the distance of 8 miles. Two *fixed red* lights, one situated about 130 yards from the end of the stone pier, and the other about 200 yards from the end of the

wooden jetty, when in line, lead over the inner bar, and between the red and black buoys.

At the outer end of the promenade pier a light is also exhibited; it shows *blue* in the channels and *red* towards the shore.

- **Tides.**—It is high water, full and change, at Morecambe harbour at 11h. 26m. local, 11h. 37m. Greenwich time; springs rise 27 feet, neaps 21 feet, and neaps range 16 feet.

Directions.—To proceed to Morecambe the services of a pilot are necessary above Wyre light; but general remarks may prove useful.

Having followed the directions for approaching Fleetwood (p. 370); from abreast Wyre light, steer up with Rossall beacon just open westward of it, which leads to the light-vessel and entrance to Grange channel, with 15 feet at low-water springs (1890), between No. 1 red conical buoy and No. 1 black can buoy; thence between the red buoys on the starboard hand, and black buoys on the port hand to the upper end of Grange channel.

A black ball at the light-vessel denotes that there is 8 feet water over Inner bar and in the shallow channel, which extends $1\frac{1}{2}$ miles below Morecambe. See tidal signals, p. 377.

Thence, with the leading light structures within Morecambe pier heads in line, bearing about E. by S. $\frac{1}{2}$ S., steer for them, passing over Inner bar (the least water 27 feet at high-water springs) just northward of Old scar, and between the red and black buoys as before; thence into the harbour.

In light winds sailing vessels must guard against being swept to the northward by the flood tide when approaching the Inner bar. Vessels lie aground in Morecambe harbour, and are well sheltered.

The town of Morecambe now includes the old watering village westward of it, formerly called Poulton le Sands. The new part of it is well built, and has some handsome terraces of houses fronting the sea. During the summer season the place presents a gay and attractive appearance, which is increased in no small degree by the very pretty country in the immediate neighbourhood, as well as by the fine views of the mountains of Cumberland in the distance. It is connected by rail with Lancaster, Carlisle, &c. Steamers run daily to and from Belfast, and from Londonderry, direct, twice a week. There are besides, during the summer season, numerous excursion steamers daily to Blackpool, Fleetwood, and Piel.

Population in 1881 was 3,931.

The estuary above Morecambe harbour is 8 miles across to the railway viaduct over the Gilpin, and is about 5 miles broad

between Humphrey head and the outlet of the Keer ; it is entirely occupied at low water by Lancaster and Milnthorpe sands, through which the Keer, from a little north of Carnforth, the Kent, and the Gilpin, which unite three miles above the viaduct, wind in shallow channels.

The embankment and viaduct over Milnthorpe sands is about 2 miles in length, the latter or central portion being supported upon iron piles for a distance of 1,550 feet, the boat channel being under the eastern end.

ULVERSTON CHANNEL, on the north-west side of Morecambe bay, is formed by the Leven, the water of which comes from lake Windermere, 12 miles above the railway viaduct, and by a tortuous and shifting channel to the westward of Cartmel wharf bank and Furness bank to the eastward, and Mort bank and flat to the westward, effects a junction with the sea 14 miles below. The entrance, between Mort and Furness banks, is marked by two black buoys, and within it is generally marked by buoys and perches maintained by the Canal company. At four hours flood there is sufficient depth over the sands and to Ulverston for a vessel drawing 12 feet. There are no licensed pilots, but men who know the channel may generally be met with at Piel harbour.

Ulverston canal, connecting Ulverston with Morecambe bay, is $1\frac{1}{4}$ miles in length, and averages 70 feet in width, with a general depth of 12 feet. The entrance lock is 108 feet in length, 27 feet in width, and opens into a basin of one acre. There is a depth of 14 feet through the lock at high-water spring tides, and 8 feet at neaps. The lock is covered by a western pier, at the head of which a light is shown when required. This canal is now crossed by the Furness railway, 150 yards below the town, and only vessels with lowered masts can pass above it.

About a dozen small vessels belong to the place, and the trade consists chiefly in the export of iron ore to Scotland and Wales.

Ulverston is a parish of 10,000 inhabitants, who are employed chiefly in the cotton manufactory ; it is connected with Lancaster by rail, distant 26 miles, which rounds the head of the bay, crossing the rivers Leven and Kent on viaducts ; it is connected also with Barrow and Whitehaven ; there is also a line to Newby bridge, near Windermere.

The monument erected on Hoad hill over Ulverston, to the memory of the late Sir John Barrow, secretary of the Admiralty, who was a native of the place, is, from its standing 417 feet above

high-water, a very prominent object from every part of Morecambe bay. (View on chart 1826.)

PIEL HARBOUR, between Walney island and the mainland, is the safest and easiest of entry of all the harbours within the limits of Morecambe bay. Vessels usually proceed to the Barrow docks, above, pp. 383, 384.

Depths in.—Piel harbour has depths of 3 to 5 fathoms at low water, and its bar, situated about $1\frac{1}{2}$ to 2 miles below, and just south-eastward of Walney island, has a dredged depth of 9 feet at low-water springs, over a breadth of 200 feet; this will give a depth of 23 feet at half tide, 30 feet at high-water neaps, and 37 feet at high-water springs. There is one foot less water in the channel, at about 2 cables within the south-east end of Walney island. South-west and West are the most dangerous winds, and cause considerable sea on the bar.

Walney lighthouse, and the ruined castle on Piel island within are conspicuous objects.

In the approach to the harbour, sand flats, with less than 3 fathoms, extend about 3 miles southward of Walney, within which distance are Lightning knoll, with 9 feet least water, Hilpsford bank, spit and shoal, Mort scar and flats, and Dione and outer boulders, the positions of which will be seen on the chart.

The entrance lies between Walney island and Farhill scar, which scar dries at low water. The point of Walney is a steep beach of shingle, but foul ground dries out on that side of the channel one-third of a mile from the south point of Piel island, for nearly 2 cables from its northern point, and the same distance on its east side. On the east and north-east sides of the harbour are Foulney and Roe islands, with extensive scars, dry at low water, surrounding them. Roe island, on which is the town of Piel, is connected by a causeway with the main, and is the terminus of a branch of the Furness railway. Foulney is connected with this causeway by a rubble causeway, awash at high water.

LIGHTS.—**Walney lights.**—About 500 yards within the south-east point of Walney island, is a stone tower 60 feet in height, from which is exhibited, at an elevation of 70 feet above high-water, a *revolving white* light, which attains its greatest brilliancy *every minute*, and in clear weather should be visible from a distance of 13 miles.

A *fixed red* light is shown from a post on Hawse point, east extreme of Walney island, about 500 yards eastward of the light-

house; it is at the south-east part of the beach just within high-water mark, and is visible seaward between the bearings East, through north, and S.W.

Caution.—The ironworks along this coast at times quite throw the harbour lights into the shade; the lights from the chimneys of Hindpool ironworks, north of Barrow, can be seen from the westward over Walney island at a distance of 15 miles and upwards in clear weather.

Piel pier light.—Piel pier extends southward of Roe island, and its extreme is covered at high-water. A *fixed red* light is exhibited from a wooden pile at its south extreme.

Pile light.—A screw pile lighthouse, showing a *fixed white* light at 26 feet above high-water, is placed on the eastern side of the channel, about 6 cables below Barrow docks; the light is visible between the bearings N.W. by W., through north and east, to S. $\frac{1}{4}$ W.

Leading lights.—The channel through Piel bar and up to the pile lighthouse is indicated by leading lights, numbered 1 and 2, on the south-east side of Foulney; a second set, numbered 3 and 4, near Rampside; and a third set, numbered 5 and 6, on the west side of Walney channel opposite Ramsden dock entrance. The front or outer light of each set, bearing an odd number, is exhibited from the summit of a piled structure diagonally boarded and painted red; the back lights are each shown from the summit of a square red brick column, the face of which is of white glazed bricks. The lights are *fixed white*, and burn night and day.

Gas buoys.—The fairway bell buoy is a gas buoy, position given below, with the other buoys. A gas buoy also lies near the extreme of the lifeboat slip, west side of Roe island.

Buoyage.—The uniform system of buoyage, as adopted by the Trinity House, is in force here, p. 19.

A bell buoy, lighted with gas night and day, boat shaped, with one mast, and marked "Barrow," is placed in 4 fathoms, on the line of Nos. 1 and 2 leading lights, two cables south-west of the depth of 9 feet on Lightning knoll, with Walney lighthouse bearing N.E. $\frac{1}{2}$ E., distant $2\frac{2}{10}$ miles.

Hilpsford shoal, with 12 feet least water, is marked by a black buoy with staff and cage, with Walney lighthouse bearing N.E. by E. $\frac{1}{2}$ E., distant $2\frac{3}{10}$ miles.

A black can buoy, with staff and cage, in 6 feet, indicates the west or inside of the bend in the dredged channel through the bar, and the

point where course is altered ; it lies with Walney lighthouse bearing N. by W. $\frac{1}{2}$ W., distant 4 cables ; and No. 2 leading light, just open northward of No. 1 leading light.

A small cask buoy, marked "Groyne," is placed off the end of the groyne, within Elbow buoy.

Seldom Seen.—On the east side of the entrance abreast the post light, distant $1\frac{1}{2}$ cables, is a red conical buoy with cross, moored 50 yards south of the Inner boulder, or Seldom Seen bank, which dries one foot at low water.

The channel above Piel is marked by red conical buoys on the starboard side entering, and by black can buoys on the port hand, and is kept dredged to a depth of 25 feet at high water neaps, and 32 feet at high-water springs up to the entrance of Ramsden dock, and 19 feet and 26 feet, respectively, up to Devonshire dock entrance. An elbow buoy, can, black, with staff and cage, marks the bend of the channel abreast the pile lighthouse. The buoys are occasionally shifted as alterations are effected by the dredging operations in progress.

Piel, known as Piel pier, is the village on Roe island, chiefly occupied by the railway employés. A pier or slip, the end of which covers at high-water, extends southward from the island to the edge of the channel. Piel is in telegraphic communication with the harbour office at Barrow.

Pilots.—There are ten Trinity branch pilots who reside on Piel island. They cruise in small schooners between the bar and Morecambe bay lightvessel. On the mainsail of each vessel is the letter B, and her number. Fleetwood pilots may conduct vessels to Piel.

Steam-tugs are always in attendance. A vessel requiring the services of a tug should hoist her ensign at the main.

Tides.—It is high-water, full and change, at Roe island, at 11h. 5m. local, 11h. 17m. Greenwich time ; springs rise 28 feet, and neaps 21 feet ; the strength of both flood and ebb is about $3\frac{1}{2}$ knots.

Directions.—Anchorage.—Vessels waiting for water to enable them to cross the bar, should keep south-westward of the bell gas buoy, or in at least 5 fathoms of water.

Care must be taken in approaching Piel harbour towards the period of spring tides, for the stream of both flood and ebb sets across its entrance, the flood from the northward, and the ebb from the southward.

Approaching Piel harbour from the south-west, steer in with Walney lighthouse bearing N.E. $\frac{1}{2}$ E., which will lead to the bell

buoy ; pass it close-to on either side, and steer in with Nos. 1 and 2 leading lights structures in line, bearing N.E. by E. $\frac{1}{4}$ E., to abreast the black can buoy ; thence with Nos. 3 and 4 leading lights structures in line bearing N.N.E. $\frac{1}{4}$ E., in about 23 feet at half-tide. The turn is somewhat sharp at the black (elbow) buoy, and starboard helm should be given on the flood before reaching it, to prevent being set on to the eastern flats. Also, when closing Hawse point, it is desirable, should the vessel be of heavy draught, to just open No. 4 light eastward of No. 3 and, as soon as the point has been passed, open them slightly the other way for a distance of about 2 cables, then bring them again in line.

From abreast the centre of Piel island, alter course to the westward, to bring Nos. 5 and 6 leading light structures for Walney channel in line, anchoring in Piel harbour if desirable.

The deepest water in Piel harbour is above the large mooring buoy, in 4 to 5 fathoms at low-water. Small craft usually lie aground on the east side of Piel island.

If proceeding to Barrow, continue on with Nos. 5 and 6, Walney channel leading lights in line, bearing N.W. $\frac{1}{4}$ N., which will lead up between the red and black buoys, and to abreast the Pile light-house ; thence steer about N. by W., between the buoys, up the channel to the docks.

Approaching Piel harbour from the northward after half-flood, Black Comb open westward of Walney island will lead in not less than 4 fathoms ; pass outside the bell buoy, and steer in with Walney lighthouse bearing N.E. $\frac{1}{2}$ E., as before directed.

At night, Walney main light should be steered for when bearing N.E. $\frac{1}{2}$ E., which will lead to the fairway bell gas buoy, but a vessel should not approach at low water into a less depth than 5 fathoms. As soon as the tide is suitable, Foulney leading lights may be brought in line, remembering that this leads just eastward of Lightning rock, on which there is 9 feet at low-water springs. As the day leading marks carry lights, the night directions are practically the same as the day.

When the dredger is moored in the vicinity of the channel, on or outside the bar, she exhibits four lights, and vessels should pass her on that side from which *two* lights placed *vertically* are shown.

Lifeboat.—A lifeboat is stationed in Walney channel, west side of Roe island.

BARROW DOCKS.—**Depths.**—Barrow docks are situated about 7 miles from the sea, and 3 miles above Piel harbour. The

channel above Piel is kept dredged to a depth of 4 feet below low-water springs, equivalent to a depth of 18 feet at half-tide, 25 feet at high-water neaps, and 32 feet at high-water springs. Between Piel and the sea there is about 4 feet more water. The Ramsden wet dock sill has $31\frac{1}{2}$ feet at high-water springs, as below stated.

Barrow is the port from which the iron ore of Furness is shipped. There are but few instances of so sudden a creation of a place of commercial importance. In 1847 the population was 325; in 1881 it was 50,000.

The great development of the Furness iron mines, some of the largest in the country, coupled with the natural capabilities of the well-sheltered bay within Walney island, has caused this rapid progress. The Hematite Steel Company's works are capable of turning out some 3,000 tons of metal per week.

The channel which formerly separated Barrow from the main has been converted into capacious wet docks, capable of receiving the largest vessels afloat; and on Barrow island there are large engine works, shipbuilding yards, and rope factories. The railway is in connection with all the quays. Here the *City of Rome*, of about 8,000 gross tonnage, and similar vessels were built.

The Naval Construction and Armament Company build and repair all classes of vessels.

Wet Docks.*—Devonshire dock has an area of 30 acres, with an entrance dock of $1\frac{1}{2}$ acres, the gates of which are 60 feet wide, with a depth on sill of $25\frac{1}{2}$ feet at high-water springs, and $18\frac{1}{2}$ feet at neap tides. Abutting on Devonshire dock are commodious warehouses, which are fitted with hydraulic cranes and other appliances for discharging and loading vessels; and on the south quay is a crane, worked by hydraulic power, which is capable of lifting one hundred tons. Within this dock is also a depositing dock, capable of lifting ships of 3,400 tons weight, and working in conjunction with a gridiron specially built for it.

Buccleugh dock, having an area of 31 acres, is entered from Ramsden dock, and also communicates with Devonshire dock, the entrances being each 80 feet in width.

Ramsden dock, south-eastward of Buccleugh dock, embraces an area of 63 acres; it has an entrance basin of 8 acres, 900 feet in length, and a lock of the same length; the entrance is 100 feet wide, with a depth of $31\frac{1}{2}$ feet on the sill at high-water of ordinary springs, and $24\frac{1}{2}$ feet at neaps. A depth of 24 feet is maintained in

* See also Dock Book.

the dock, and 6 feet more depth in the basin and lock, which have several crane berths for lightening and loading up heavy draught vessels. Commodious sheds have been erected on the dock quays throughout their whole length, besides warehouses, cattle sheds, hydraulic and steam cranes.

Cavendish dock, of 142 acres, has an entrance from Ramsden dock of 80 feet ; it is used as a timber float.

North-eastward of the west entrance of Devonshire dock is a graving dock 500 feet in length, with an entrance 60 feet in width, having a depth of $22\frac{1}{2}$ feet on the sill at high-water spring tides.

There is a patent slip adapted for vessels of 500 tons.

LIGHTS.—The lights leading up to the docks are described on page 381. The *electric* light is used for Ramsden dock and basin entrance. A *fixed green* light is shown at the wooden pier on the west side of Barrow island, and another on Belfast quay above Ramsden dock entrance. A *fixed green* light is also exhibited from the south-west corner of the pier-head at Devonshire dock.

Signals.—A red flag, by day, hoisted at the pier-head flagstaff, Ramsden dock, and a *red* light by night, indicates that the gates are open.

A black ball under the red flag by day, and two *red* lights by night, signifies that the basin entrance is not clear.

Directions for Piel harbour and Barrow are given at page 382.

Trade.—The principal exports are iron ore, pig iron, and steel rails ; and the imports are timber, grain, jute, and iron ore. The average number of vessels entering per annum for the six years ending 1888, was 1,965, of the registered tonnage of 518,395 tons.

Steam-vessels run daily to Belfast, and weekly to Glasgow and the Bristol channel ports ; there is also communication with Rotterdam, Antwerp, Quebec, Montreal, &c., and in the summer months to Douglas in the Isle of Man.

Sailors' Home.—There is a Sailors' Home, and a hospital for surgical cases.

Supplies.—All kinds of supplies are obtainable at Barrow. Coa at short notice.

Measured mile.—See page 389.

WALNEY ISLAND, within which is Piel harbour and the port of Barrow, is 7 miles in length in a general north and south direction, by about three-quarters of a mile across at the broadest part ; the whole of it is low, the greatest elevation, 64 feet above high

water, being near the church, abreast Barrow. The lighthouse, church and a windmill towards the north end of the island are conspicuous objects. A channel one-quarter of a mile wide, known as the Scarf, within Duddon bar, leads northward and eastward of Walney island, to Barrow, and is referred to below. *See lights*, p. 380.

Cockspeck scar.—Foul ground extends generally off the sea face of Walney island for one mile, and depths of 6 to 7 feet upon Cockspeck scar, lying abreast the church, will be found at that distance from the land. Wyre pile lighthouse, kept open of the south-west point of Walney, leads westward of it in about 15 feet at low-water.

DUDDON RIVER* has its source about 6 miles west of Ambleside, in the valley between Langdale and Furness Fells, and near the junction of Westmoreland, Cumberland, and Lancashire, forming the boundary of the two latter counties from its source to its confluence with the sea, a distance of about 28 miles. At Boughton-in-Furness it expands into what is termed Duddon-mouth, up to which point the estuary is navigable for small craft; and eleven miles lower down, the river, after many windings, joins the sea between Walney and Haverigg. A little below Boughton the estuary is crossed by the Whitehaven and Furness railway upon a wooden viaduct 400 yards in length.

An extensive red hematite iron mine is being worked by the Hedbarrow Mining Co., on the west side of the estuary, at the promontory situated between Haverigg and Millom. A sea wall, about half a mile in length, has been constructed on its south side, to enable the mining to be carried on under the sea bed. There is a depth of 20 feet alongside it at high water, but it is fully exposed to the prevailing wind and sea which breaks with considerable violence over it at times.

Millom.—The Whitehaven and Furness railway passes through the town of Millom (Holborn Hill), crossing the estuary some 3 miles above, where it is less than half a mile wide. Population (1881) was 6,228.

Bar.—Depths.—The estuary of the Duddon, about 5 miles in length, with a width of about 2 miles, is encumbered by sandbanks to the distance of 2 miles seaward of its entrance points, or between Walney island and the point westward of Haverigg village, separated by a distance of 3 miles. The bar and channel are so changeable that its navigation can only be undertaken by those locally acquainted. The bar has about 32 feet at high-water springs, and 6 feet at low-

* *See Admiralty chart* :—Formby point to Firth of Solway, No. 1,826.

water springs, but the channel is then dry between the entrance points.

Vessels of 500 tons are able at high-water to reach the pier below Millom, at the north-east extreme of the peninsula. Here they load ore from the mines before mentioned, which are close within.

Buoys.—A fairway, red conical buoy, in about 5 fathoms, lies about half a mile outside the bar, with Walney mill S.E. $\frac{3}{4}$ E., distant $3\frac{1}{4}$ miles. Black buoys mark the best channel of the river within the bar, which is confined by Haverigg spit and bank on the north, and by the sands extending north-westward of Walney, and by Duddon banks, on the south. The buoys must not be depended on.

The **Scarf channel**, within Duddon bar, leads round the north end of Walney and on to Barrow, affording 14 feet at high-water springs; it is occasionally used by coasting craft.

Clearing marks.—**Directions.**—Strangers must obtain a pilot for the Duddon. To clear all the outlying sands at the entrance of the Duddon, keep Wyre pile lighthouse open of Walney island, bearing S.S.E. $\frac{1}{2}$ E.; and Black Comb eastward of N.E. $\frac{1}{2}$ N. At night, St. Bees' light in sight (just dipping), leads westward of Duddon fairway bar buoy; a depth of 8 fathoms at low-water also leads clear of all danger.

Tides.—It is high-water at Duddon bar, full and change, at 10h. 54m. local, 11h. 5m. Greenwich time; springs rise 26 feet, and neaps 19 feet.

COAST.—**Aspect.**—From the Duddon the coast trends nearly north for 7 miles to Selker point. Black Comb, elevated 1,919 feet above high-water, about midway, and 2 miles back from the coast, is useful as a sea-mark; it has an unbroken rounded outline, and the hills of Lockna Banks, 515 feet, partially cultivated, lie a short distance to the southward of it; the whole being terminated seaward by a line of reddish cliff and braes. Black Comb is succeeded by high land in a north-east direction, with a well-cultivated foreground.

SELKER ROCKS.—**Beacon.**—Rocks and foul ground extend from one to $1\frac{3}{4}$ miles off-shore from abreast Black Comb; the most southern is the Black Leg, which dries 2 feet at low-water springs; two miles northward is the Scala Fold Style, which is awash at the same time; this nearly connects with Selker rocks, which extend $1\frac{1}{2}$ miles off Selker point, in the south-west approach to Ravenglass. The middle of the rocks, dry at low-water springs, is marked by a perch $1\frac{1}{8}$ miles from the point.

Clearing marks.—St. Bees' head light is masked from the bearing North toward the land, the limit of light leading one-third of a mile outside the two-fathoms line of soundings at Selker rocks, or in 10 fathoms at low-water, inside which depth no vessel, when abreast the rocks, should venture.

LIGHT - VESSEL.—From Selker light-vessel, moored in $10\frac{1}{2}$ fathoms, with Selker rocks beacon bearing E. by N. $\frac{1}{4}$ N., distant 2 miles, is exhibited, at an elevation of 38 feet above the sea, a *double-flashing* light giving *one white* and *one red flash* in quick succession *every half-minute*, visible in clear weather from a distance of 11 miles. The vessel has *Selker* painted on her sides, and carries a diamond at the masthead.

Fog signal.—A gong is sounded in thick or foggy weather.

RAVENGLASS HARBOUR is situated in the small estuary, dry at low-water, into which the small rivers Esk, Mite, and Irt, discharge through a narrow, winding, and changeable channel. Its entrance is about one-third of a mile in width, but sands and scars, dry at low-water, extend nearly one mile seaward of it.

The entrance channel, dry at low water, has, on the line of the leading marks, a depth of about 18 feet at high-water springs, and 11 feet at high-water neaps. Within, the depths are about 2 feet less to Ravenglass. Coasting craft of less than 11 feet draught occasionally enter the harbour and lie aground.

The entrance to the harbour may be readily identified by the coast sand-hills, Esk Meals and Drigg Hawes, which extend respectively about 3 miles southward and northward of it; and by the long sloping hill of Newton Knot to the southward of Ravenglass, on which is a tall pillar.

The Irt, Mite, and Esk streams have their sources near Scar Fell Pikes in Cumberland, the first from Wast Water, 13 miles from Ravenglass; the second near Birnmoor tarn, 8 miles; and the third near Angel tarn, 18 miles.

Drigg rock, with a depth of 6 feet at low-water springs and steep-to on its seaward side, is the outer danger northward of the harbour; it lies one mile from the shore, with the sea mark bearing S.E. $\frac{1}{2}$ E., distant 2 miles.

Tides.—It is high water, full and change, at Ravenglass, at 11h. 20m. local, 11h. 34m. Greenwich time; springs rise 26 feet, neaps, 19 feet; the flood comes from the northward.

Directions.—Strangers about to enter Ravenglass harbour should employ a pilot. Approaching Ravenglass, keep 2 miles off the coast to avoid Selker rocks to the southward, and Drigg rock to the northward, until the leading mark is nearly on.

The mark for the entrance is the sea-mark in line with the pillar on the south shoulder of Newton Knot hill, bearing E. $\frac{1}{4}$ N. (view D. chart 1826) ; when about 3 cables from the sea mark, steer for the village, off which the vessels beach.

In moderate weather vessels waiting a favourable tide may anchor off the coast in about 8 fathoms, over sand and shells, as the tides are weak.

Village.—The village of Ravenglass in 1889 had 280 inhabitants, chiefly engaged in oyster fishing, and in making patent manure ; there is no coasting trade, and there is no wharf accommodation. The Whitehaven and Furness railway sweeps round the estuary, passing through Ravenglass.

COAST.—Seascale.—From Ravenglass, the coast trends northward to St. Bees' head, distant 12 miles, skirted by the Whitehaven and Furness railway as far as the village of St. Bees' ; for 3 miles northward of Ravenglass it is composed of low sand hills, to within one mile of Seascale, where it attains an height of 111 feet. The background is mountainous, Sca Fell, about 10 miles from the coast, being 3,092 feet in height. St. Bees' head (described on page 392) is a perpendicular cliff of 301 feet. *See* sketch on chart 1826. The village and college of St. Bees' show plainly from abreast.

Lifeboat.—A lifeboat is stationed at Seascale.

Cochra and Barn scars, dry at low water, extend three-quarters of a mile from the shore, at $1\frac{1}{2}$ miles northward of Drigg rock, and the low-water feature of sand and stones dries off between them and St. Bees' from one-third to three-quarters of a mile ; 4 miles southward of St. Bees' lighthouse are the rocks known as Longman scar and Ben rock.

Clearing mark.—The whole shore from abreast Drigg rock is clear of danger at the distance of one mile off, with depths of 5 to 7 fathoms at that offing. St. Bees' light in sight at night leads clear of all danger.

Measured mile.—The Barrow Ship Building Company has laid out a mile of 6,080 feet, marked by two pairs of beacons, on the shore at Seascale about 8 miles southward of St. Bees' head.

CHAPTER XIII.

ST. BEES' HEAD TO MULL OF GALLOWAY.
FIRTH OF SOLWAY.

VARIATION IN 1891.

At the entrance of the Firth $19^{\circ} 40' \text{ W.}$ | Off Silloth - $19^{\circ} 30' \text{ W.}$

FIRTH OF SOLWAY.*—General remarks.—The Firth of Solway lies between St. Bees head on the Cumberland coast, and Abbey head in the Scotch county of Kirkcudbright, separated by a distance of 19 miles; from these points the distance up to Annan, where navigation may be said to cease, is about 28 miles. A large portion of this wide and extensive inlet is encumbered by shifting sand banks, with deep water channels between them; the best navigable channel is on the English shore, and is lighted and buoyed; the others are unbuoyed.

South-westerly gales generally cause the highest sea in the Firth; with the wind between S.W. and N.W. a heavy sea is found as far as Workington, but it falls as the vessel proceeds farther up. A vessel having arrived at the entrance of the Firth in a south-westerly gale, and being upon the English shore, would find but little difficulty in reaching Maryport road, where the sea is reduced by half, or by careful navigation even to Silloth road. In misty weather, no vessel should attempt to proceed to the inner part of the Firth until Maryport, or the Two-feet bank buoy, has been sighted.

No vessels without local knowledge should enter the Firth on the Scotch side, for the banks are there farther off shore, and there are no leading marks or buoys to guide the seamen.

Clearing marks.—While working in, or crossing the outer part of the Firth, observe that the Screel, the eastern peak of Bengairn mountain, open to the westward of Great Aird on the Scotch coast, bearing $N. \frac{1}{2} W.$, leads westward of all the sands, in about 15 feet; see view A., chart No. 1346; bearing in mind the shifting nature of the sands, it is advisable not to bring the Screel westward of North. See directions, page 405.

Caution.—The numerous iron-works along this coast are liable to bewilder a stranger, and they at times quite throw the harbour lights

* See Admiralty chart, England, west coast, firth of Solway, No. 1,346; scale $m = 1.0 \text{ inch.}$

into the shade; the lights from these works are particularly vivid between St. Bees' head and Whitehaven.

Tidal harbours.—Buoyage.—The tidal harbours of Whitehaven, Harrington, Workington, Maryport and Silloth on the English coast, are the chief trading ports in the Firth. Red conical buoys mark the starboard side of the channel above Maryport, where the buoyage begins, and black can buoys the port side, but on account of the shifting nature of the sands, the services of a pilot are advisable for the Firth above Maryport. The buoys belong to the North British Railway Company, with the exception of Two-feet bank buoy, which belongs to the Trinity House.

Tidal streams.—It is high-water, in the entrance to the Firth, at 11h. 10m. local, and 11h. 24m. Greenwich time; springs rise 26 feet, neaps 19 feet. About one mile southward of St. Bees' head, the stream runs for 9 hours to the south-eastward, from 2 hours ebb until the last hour of the flood; when it runs north-east for 3 hours, or until 2 hours after high-water.

Five miles off the head, the flood stream sets about S.E. by E. at the rate of one knot, and the ebb N.W., three quarters of a knot per hour, about 6 hours each way. The flood and ebb streams set in and out of the Firth of Solway, along the Cumberland coast, between Whitehaven and Workington, commencing at about low and high-water by the shore, respectively. The rate of each stream is from $2\frac{1}{2}$ to 3 knots at springs, and $1\frac{1}{2}$ knot at neaps.

At 5 miles north of St. Bees, the flood and ebb set E.N.E. and W.S.W., respectively, to abreast Workington, with a rate of 3 knots at springs, and $1\frac{1}{2}$ knot on neaps. In English channel, between Workington and Silloth the flood runs 5 hours, and the ebb 7 hours; their maximum rate being 4 knots during springs, and 2 knots during neaps; turning at about high and low-water at Silloth.

Off Lee scar and Silloth there is but little stream of tide, except during the last-quarter flood and first-quarter ebb, when the banks above Silloth are covered.

The flood sets in an easterly direction along the Scotch shore, and through all the channels towards the Nith; both flood and ebb run principally through Middle channel and its continuation to Annan. Over the outer part, the maximum rate is $3\frac{1}{2}$ knots at springs, and 2 knots at neaps, but as the channel narrows towards Southernness point, its rate increases to 4 or 5 knots at springs, and 3 knots at neaps, these rates continuing as far eastward as Annan, off which place it occasionally runs at the rate of 6 knots.

Off Southernness the flood runs 5 hours, and off Annan about 4 hours.

ST. BEES' HEAD, the south point of entrance to the Firth of Solway is a perpendicular cliff of red sandstone, about 280 feet in height, with a flat summit within it (*see sketch on charts 1,346 and 1,826*), and, with its lighthouse, is easily recognized from a considerable distance seaward.

LIGHT.—From a light tower 55 feet high, painted white, erected near the western edge of St. Bees' head cliff, is exhibited at an elevation of 336 feet above high-water, a *white occulting half minute light*, visible in clear weather from a distance of 25 miles. The light is visible 24 seconds, eclipsed 2 seconds, visible 2 seconds, eclipsed 2 seconds, every half minute. Inshore of the bearing North, or one-third of a mile outside Selker rocks, the light is obscured.

The village of St. Bees stands on a rise near the coast, about 2 miles south-eastward from the lighthouse; it is noted for its ancient abbey, part of which has been converted into a theological college.

A Telegraph cable (submarine) is laid from below the south head of St. Bees to Port Cornah, Isle of Man, a distance of 28 miles.

Saltom bay.—Anchorage.—From St. Bees' head the coast trends north-easterly for $2\frac{1}{2}$ miles to Whitehaven, forming Saltom bay, named from some extensive coal pits near high-water mark westward of Whitehaven. For one mile from St. Bees the cliffs are of sandstone with several quarries in them; thence both the elevated backland and the coast cliffs descend gradually. Saltom bay, which is skirted by oyster grounds, affords a good anchorage in off-shore winds, but the depth is under 3 fathoms at low-water within half a mile of the shore.

The depths in approaching Whitehaven are regular, and anchorage may be taken up abreast the entrance, at half a mile distant, in 5 or 6 fathoms, sand.

WHITEHAVEN HARBOUR is a tidal harbour of about 50 acres enclosed by piers, which affords excellent shelter in all winds.*

The outer harbour contained between West and North piers and Old quay, is 25 acres in extent, with an entrance 500 feet in width just dry at low-water springs; within, it has depths varying from 20 to 26 feet at high-water springs, and 7 feet less at neaps.

Vessels of 22 feet draught can enter at high-water springs, and 15 feet at high-water neaps.

* *See Admiralty plan of Whitehaven, No. 1,775 : scale, $m = 20$ inches.*

The inner harbour is within Old quay, with an entrance 150 feet in width; the five portions into which it is divided, by quays, also amount to about 25 acres.

The two western portions of the Inner harbour, separated by Old Tongue pier, are known as South harbour, $4\frac{1}{4}$ acres; and Custom house harbour, 3 acres; the two eastern portions, eastward of Bulwark pier, are North harbour, $3\frac{1}{2}$ acres; and Queen's wet dock, $4\frac{3}{4}$ acres, the latter being entered from North harbour; the middle portion, 9 acres in extent, is known as Inner harbour. The principal quays are connected with the railway and mines, and are fitted with cranes capable of lifting from 2 to 10 tons, and every requirement for the rapid loading and discharging of vessels.

The Queen's wet dock has 22 feet over its sill at high-water ordinary springs. See page 395.

The whole of the quays are lighted.

LIGHTS.—From the lighthouse, 47 feet in height, on the west pier-head, is exhibited, at an elevation of 52 feet above high water, a light which *revolves every two minutes*, and visible in clear weather from a distance of 11 miles.

From the white lighthouse on the North pier-head, at an elevation of 52 feet, is exhibited a *fixed green* light.

Tidal light and signal.—A *fixed red* light is shown from near the head of the Old quay from about half-flood to half-ebb, or when there is a depth of 9 feet in the entrance to Inner harbour. By day the same depth is indicated by a red flag at the head of the New quay, in the Outer harbour.

Fog signal.—For the purpose of guiding vessels into the harbour during thick or foggy weather, a steam whistle on the west pier-head gives blasts of *five seconds* duration *every half-minute*, between half-flood and half-ebb.

Tides.—At Whitehaven it is high water, full and change, at 11h. 14m. local, 11h. 28m. Greenwich time; the tide rises at equinoctial springs 28 feet, at ordinary springs 26 feet, and at neaps 19 feet.

Pilots.—Harbour pilots are always on the look out, and are to be procured by hoisting the usual pilot signal. The charge is by agreement. The use of the harbour boat is compulsory.

A **steam-tug**, the use of which is optional, is attached to the harbour, for which the signal is an ensign or union jack at the main-top-gallant masthead by day, and two lights vertically by night.

Lifeboat.—There is a lifeboat station just eastward of the harbour, and also a rocket apparatus.

Directions.—The harbour dries throughout at low-water springs, but small vessels may enter at early tide, and at low-water neaps there is a depth of 7 feet within the western pier-head. A red flag at the New quay-head denotes 9 feet or more in the entrance to Inner harbour. *See* tidal light, p. 393. Vessels drawing 22 feet may enter the Inner harbour at high-water springs, and those of 15 feet draught during neaps, as before stated.

In entering, keep close to the West pier head, as the flood stream sets eastward across the harbour's mouth; then steer between the jetty and the Old quay-head, and berth the vessel as convenient.

Caution.—So long as a vessel is manageable, and there is sufficient water, she may enter Whitehaven, even in a heavy gale; but in a sailing vessel, with scant winds, it is necessary to keep lofty canvas set, and to hug the West pier head closely until well within it, for a heavy sea is thrown across the entrance in westerly gales, and many accidents have at such times occurred from vessels not observing these precautions; and being also influenced by the flood stream, they have not unfrequently missed the entrance, and become stranded behind North pier. If forced to run ashore under such circumstances, keep as close as practicable to the back of North pier, as there is less sea there, and the vessel is more within reach of assistance.

WHITEHAVEN is a parliamentary borough; its chief trade consists in the exportation of coal, which is extensively worked in the immediate vicinity; also steel rails, sleepers, pig-iron, lime, and free-stone; and in the importation of corn, manure, timber, iron-ore, cement, cattle, and general produce. In the season there is also an extensive herring fishing.

Population in 1889 was 19,321.

Communication.—There is railway communication from the south, and *via* Maryport to Carlisle; and steamers ply to and from Belfast, Dublin, Dundrum, Isle of Man, and Liverpool.

Supplies.—Good water is led down in pipes to all the quays, and supplied at a moderate charge. Other supplies are plentiful. Coal can be supplied at the rate of 100 tons an hour to each hatchway.

Time signal.—A ball is dropped daily (except Sundays and general holidays) at 10h. 0m., Greenwich mean time, from a staff surmounting Sutton's clock, Lowther street.

Docks.—The Queen's wet dock is $4\frac{1}{4}$ acres in extent, with an entrance 50 feet in width, and a depth of 22 feet over the sill at high-water springs, and 15 feet at neaps. It is fitted with steam cranes and other appliances for the rapid discharge of cargo; the railway lines are laid on all its quays.

There is a patent slip at the head of the Custom-house harbour adapted for vessels 250 feet in length, and every facility for executing repairs; and also a gridiron 150 feet in length, with a depth of 12 feet at high-water springs; there is also a building yard for the construction and repair of iron vessels.

Sailors' home.—There are two sailors' homes and a port sanitary hospital.

Coast.—From Whitehaven, the cliffy coast, fronted at low water by rocky ledges and loose stones from one to 2 cables at low water, trends in a general north-east direction to Harrington, distant about 4 miles. The railway skirts the high-water line, and is backed by cliffs from 50 to 100 feet in height; the village of Parton, one mile from Whitehaven, has a conspicuous church with a square tower; several conspicuous chimneys mark this portion of the coast.

HARRINGTON, which is prominently marked by some blast furnaces just to the southward of it, has a small artificial harbour, through which a stream discharges. The south side of the harbour is formed by a stone circular pier, from the elbow of which a new pier extends 133 yards W.S.W., and the northern side by two wooden breakwaters, within which is Scotch quay; these various projections divide the contained space into an outer and inner harbour, the latter furnished with coal-tips.*

The foreshore dries at low water for the distance of a quarter of a mile seaward of the pier.

The small harbour affords good shelter with all winds, but some sea is thrown in during strong northerly gales. Vessels drawing 13 feet are admitted at high-water springs, and those of 7 feet at neaps. In entering keep in mid-channel.

Tidal lights and signal.—Two lights, vertical, *red over white*, and two feet apart, are exhibited from the outer extreme of the new pier, while there is a depth of 8 feet into the harbour; the red light is 25 feet above high-water springs.

At the head of the south circular pier is exhibited from a pedestal,

* See Admiralty chart :—Firth of Solway, No. 1,346.

at an elevation of 44 feet above high water, a *fixed white* light, while there is a depth of 8 feet into the harbour; by day, a red drum, hoisted at the inner end of the same pier, indicates a like depth.

Tides.—It is high water, full and change, at Harrington, at 11h. 15m. local, 11h. 29m. Greenwich time; equinoctial springs rise 27 feet, ordinary springs 25 feet, and neaps 19 feet.

Trade.—Harrington is a port chiefly for the exportation of iron and coal. Iron vessels of upwards of 1,000 tons are built there.

In 1888, 327 vessels entered the port of the aggregate tonnage of 23,737 tons register.

In 1881 the population was 3,019.

Coast.—From Harrington the coast trends northward for $2\frac{1}{4}$ miles to the harbour of Workington, and is fronted by a stony foreshore to the distance of 2 cables at low-water. Just to the southward of Workington pier, Chapel hill, elevated 116 feet, with a square white tower on its summit, the ruin of a chapel, is a well-marked object; on its north end is a white-washed mark, named the Hottentot kraal. Between Chapel hill and Harrington there are several tall chimneys.

RIVER DERWENT takes its rise among the mountains at the head of Borrowdale, $1\frac{1}{4}$ mile north-east of Sea Fell Pikes, 3,210 feet above mean sea level. It joins Derwentwater, $7\frac{1}{2}$ miles from its source, issues from the north end of that lake near Keswick, and is there joined by the Greta; it then winds through a marshy plain at the south-west foot of Skiddaw for 3 miles, and enters the lake Bassenthwaite, which is $3\frac{1}{2}$ miles long, and from thence flows on by Cockermouth, Great Broughton, and Camerton, to Workington, where, at half a mile below the bridge it falls into the sea; its total length, including $2\frac{3}{4}$ miles through Derwentwater, being 36 miles; its outlet forms Workington harbour.

WORKINGTON HARBOUR and dock, at the outlet of the Derwent, is the property of the Earl of Lonsdale, and is fronted by a stony foreshore, dry to the distance of one-third of a mile at low-water. Vessels loading or discharging at Workington can enter the Lonsdale wet dock on the north side of the harbour; it is 600 feet in length by 300 feet in breadth, and contains above $4\frac{1}{2}$ acres; the entrance gates are 40 feet wide, and over the sill there is a depth of 16 feet at high-water springs, and 10 feet at neaps; the harbour has about the same depth. There are steam cranes and other appliances for the loading and discharging vessels in the dock. Water is led down to the quays.

The harbour entrance is protected by a breakwater, which extends a distance of 500 feet in a north-west direction beyond John's pier, at the south side of entrance; within on the same side is a wooden pier, the new quay jetty, and main pier, containing between them a space named the old dry dock; farther in is Merchants' quay, between which and the main pier is the small harbour. On the northern side is Lonsdale dock, before mentioned, and the channel of the river is bounded to abreast the inner end of John's pier by a curved rubble wall marked by perches.

The entrance of the channel is marked by small red buoys on the south side, and by small black buoys and perches on the north side, the outer perch having upon it a cask painted black.

Workington bank, situated $2\frac{1}{2}$ miles westward of the port, is described on page 402.

Tidal lights and signals.—A *fixed red* light is exhibited, at 42 feet above high-water, from the head of the breakwater extending from John's pier, south side of entrance, while there is a depth of 8 feet into the harbour. A red ball is hoisted by day at the heel of John's pier to indicate the same depth of water.

Two *fixed green* lights, for leading in, are shown from white towers during the same period as the tide light on the breakwater; the lower lighthouse is placed at the outer end of the timber jetty on the north side, and the upper lighthouse at the north-west end of Lonsdale dock.

On the end of the Old wooden pier, on the south side of harbour, a *fixed red* light is also shown at tide-time.

It is at times difficult to distinguish these lights owing to the number of blast furnaces in their neighbourhood.

Tides.—It is high-water, full and change, at Workington, at 11h. 20m. local, 11h. 34m. Greenwich time; ordinary springs rise $25\frac{3}{4}$ feet, and neaps 20 feet.

Pilots and tugs.—Two steam-tugs belong to the harbour; the signal for one is a flag by day, and two lights vertically at night. There are no licensed pilots, but the harbour boat is always in attendance at tide-time day and night.

Directions.—Workington harbour and dock admits vessels drawing about 16 feet at high-water springs, and 10 feet at neaps, as before mentioned. Vessels waiting tide may anchor abreast the port in light winds and settled weather.

Proceed in with the white towers, or the *green* lights on them by night, in line bearing E.S.E., and between the red buoys on the

starboard hand, and the black buoys and perches on the port hand, until the *red* light opens on Old pier on the south side of the river, then port the helm, keeping the lower *green* light on the port hand, and the *red* light on the starboard hand.

If bound for the dock, have ropes ready on the port bow and quarter for the men in attendance on the west pier.

Small craft go a considerable distance up the harbour, where they have the advantage of good wharfage.

The town of **Workington** is situated on the south side of the river ; the lower portion is on the same level as the harbour, but the upper and principal part is on an eminence. The Derwent is crossed by a three-arched road bridge above the town, and by a railway viaduct half a mile within the entrance.

Besides the coast railway to Maryport, there is a line through Cockermouth and Keswick to Penrith, distant 39 miles. There is also a steam-vessel once a fortnight to Belfast. Population in 1888 was 23,000.

Trade.—Extensive coal-pits are worked in the neighbourhood, and there are also large ironworks which furnish the chief portion of the export trade.

The principal exports are rails, pig and bar iron, steel sleepers and plates, and the import is ore. 1,428 vessels entered the port in 1888, of the aggregate tonnage of 116,307 tons.

Patent slip.—The port possesses a patent slip adapted for vessels of 350 tons, a gridiron capable of taking vessels drawing 10 feet, and three large building sheds, under which vessels of 1,200 tons burden have been built.

Supplies, Repairs.—The ordinary supplies of provisions and ship chandlery are obtainable ; coal may be put on board either in the dock or harbour. There are various shops, joiners, fitters, &c., at the dock and harbour ; there is also an infirmary, and a hospital for infectious diseases.

Coast.—From Workington the general trend of the coast is north-east $4\frac{1}{2}$ miles to Maryport, the village of Flimby lying in a bight about 3 miles distant. The coast is low, with rising ground half a mile in the rear. The foreshore, half a mile wide at low-water, is of loose stones and slag from the furnaces, changing to fine sand near Flimby. From hence to Maryport, the coast is of the same character, with detached masses of stone lying outside the low-water margin in places ; and the bottom is foul, with less than 2 fathoms depth, for $1\frac{1}{2}$ mile off shore. The blast furnaces at Workington and

Maryport, and the numerous tall chimneys of the coal mines and other works, are conspicuous objects; at night, the lights of the furnaces have a remarkable appearance.

MARYPORT ROAD, situated abreast the port, affords anchorage from all but westerly winds, and there is no great difficulty in reaching it without a pilot. Vessels about to enter the harbour may anchor in $3\frac{1}{2}$ to 4 fathoms, over clay, in the inner part of the road, with St. Bees cliff in line with the lighthouse on the outer extreme of Workington breakwater, and Maryport outer light S.S.E. $\frac{1}{2}$ E., distant $1\frac{1}{10}$ miles.

The three fathom edge of the bank fronting the shore is nearly one mile off the lighthouse, with a depth of 9 to 10 feet only at 8 cables off.

Deep draught vessels should anchor in the outer part of the road, half a mile outside the narrow bank, with depths of 14 to 18 feet, extending parallel to the shore for a distance of 2 miles. Here are depths of about 6 fathoms, stiff clay, with Maryport light bearing S.E. by S., distant $2\frac{1}{4}$ miles.

In approaching Maryport road from the southward, the coast between Workington and Maryport should not be approached within the distance of $1\frac{1}{2}$ miles when near low-water, as depths of 10 to 18 feet will be found within that distance. Abreast Workington, and distant nearly $2\frac{1}{2}$ miles, is Workington bank, with a least depth of 16 feet. The channel to Maryport, between, has depths of 6 to 9 fathoms. *See Directions*, p. 405.

Caution.—From abreast Maryport, and even to some distance below it, the whole body of the Solway firth is occupied by dangerous sand-banks, subject to frequent change, and many of which dry at low-water, while the fore-shore at low-water, north-eastward of Maryport, gradually gains in breadth until it becomes an extensive outlying flat forming the south-east boundary of the main navigable channel. These various dangers, and the navigation through them, will be found described under the head of Sandbanks, p. 402.

MARYPORT HARBOUR.—The tidal harbour of Maryport is dry at low-water springs to the distance of about 50 yards beyond the outer pier. The depth of water at the outer pier-end is 26 feet at high-water springs, and 20 feet at neaps, with about one foot less water in the channel to the Senhouse dock. This admits, in fine weather, of the passage to the wet docks of vessels drawing 24 feet at high-water springs and 18 feet at neaps.

The harbour is contained between several piers and jetties, constructed from time to time, as additional accommodation was required.

The south side of the entrance is formed by a wooden pier, which extends to near the low-water margin.

On this side of the river there is the south jetty and south quay ; between the inner end of the south pier and south jetty is the basin of the Senhouse dock, and between the south jetty and south quay is the basin of the Elizabeth dock. The north side of the harbour is formed by the north pier, the tongue, and the north quay. The channel of the Ellen, at the upper part of the harbour, is crossed by a swing bridge with an opening of 46 feet.

The construction of the south breakwater has intercepted a range of sea which formerly troubled the harbour, and the channel runs parallel with, and close along, the north-east face of the pier, till the harbour is entered, which latter is well protected from all winds.

Wet docks.—The Senhouse wet dock of 6 acres, opened in 1884, is 850 feet in length, 300 feet in breadth, with an entrance 50 feet wide, and depth on sill of 25 feet. A steamer, with 3,900 tons of cargo, and drawing 23 feet 10 inches, has cleared from it. The dock is fitted with ample steam crane and other appliances for the rapid discharge and loading of vessels, and the railway runs on to the quays. The new tidal basin is 8 acres in extent, and is a valuable adjunct to this dock.

The Elizabeth dock, of $3\frac{1}{2}$ acres, situated eastward of the Senhouse, is 600 feet in length, 240 feet in breadth, with an entrance 50 feet wide, and depth on sill of 20 feet at high-water springs ; it is entered from a tidal basin of $2\frac{1}{4}$ acres.

Patent slip.—There is a patent slip, recently made, capable of taking most vessels that frequent the port ; also a gridiron for vessels 250 feet in length, with a draught of 12 to 14 feet.

LIGHTS.—A *fixed white* light is shown all night from a white lighthouse on the outer end of the south or wooden pier ; it is elevated 30 feet, and is visible at the distance of 6 miles.

A *fixed red* light is shown all night from the outer end of the north pier at an elevation of 30 feet.

Tidal lights and signals.—A *fixed white* light is shown from a lighthouse, 42 feet in height, on the stone pier-head, at the inner end of the south pier, at 55 feet above high-water, while there is a depth of 8 feet into the harbour ; it is visible at the distance of 12 miles. A red ball is hoisted by day upon a flag-staff near this inner lighthouse to indicate the same depth. A *fixed red* light below the *fixed white* light, or two red balls, denote that the channel is obstructed. A *fixed red* light is shown from the head of the south

jetty, and a *fixed green* light from the head of the tongue on the north side.

It will be seen that white and green lights mark the south side of the harbour and red lights the north side ; these tidal lights are shown while there is a depth of 8 feet into the harbour.

Tides. — It is high-water, full and change, at Maryport, at 11h. 26m. local, 11h. 40m. Greenwich time ; springs rise 25 feet, neaps 19 feet.

Pilots and Steam-tugs. — There are no licensed pilots for Maryport, but fishermen, many of whom are well qualified to take charge of vessels, are always on the look out. A harbour-boat is, however, always in readiness at tide time to attend warps, &c. Steam-tugs are also in attendance at tide time ; the signal is a union jack at the main by day, and two lights vertically by night.

There is a licensed pilot for Silloth stationed at Maryport.

Directions. — Vessels drawing 24 feet, if the water is smooth, can enter Maryport harbour at high-water springs, and those of 18 feet draught at neaps. No special directions are necessary. In entering, keep the light on the head of the south pier on the starboard hand ; then pass along the pier, about 30 feet distant, to the docks or inner harbour, having previously prepared a warp to hand to the harbour-boat to check the vessel's way, if necessary, and have both anchors ready.

From the end of the north pier, a large-linked chain extends seaward, parallel to the wooden pier, for the purpose of catching the anchors of sailing vessels which have missed the harbour, to prevent them drifting on to the north beach.

MARYPORT stands chiefly upon an eminence on the north side of the outlet of the river Ellen, a small stream which springs out of Caldbeck fells to the north of Skiddaw, and is about 23 miles in length.

The town is connected by the North-Western Railway system with all parts of the United Kingdom ; rails are laid also on all the quays of the harbour and docks in connection with the tramways of the local ironworks.

The population in 1881 was 8,126. Since the opening of the Senhouse dock the trade of the port has considerably developed.

Supplies. — Water mains are laid round the quays, and any quantity of coal is obtainable from the coal tips in the docks. Ships' stores of all kinds are plentiful, and repairs to engines and boilers are undertaken by local firms. Large iron vessels are built here.

Coastguard.—Lifeboat.—There is a lifeboat at Maryport, and a coastguard station just northward of the harbour. There is also a battery for drilling the Naval Reserves.

Trade.—The chief trade consists in the export of steel-rails, pig-iron and coal ; and the imports, of iron-ore, grain, timber and general produce. In 1888 the totals amounted to about 500,000 tons. In the same year 1588 vessels cleared, the registered tonnage being 254,971 tons.

ALLONBY BAY.—The coast from Maryport trends north-east three-quarters of a mile to Bank-end, the south-western boundary of Allonby bay, the low-water shore of which is composed of loose stones, the soundings decreasing regularly towards it. Dubmill point, the north-eastern horn of the bay, is $1\frac{1}{2}$ miles beyond the village of Allonby, which lies in the bight. The coast is low, backed by gradually rising ground, and the shelving fore-shore, generally one-third of a mile wide, consists of sand with patches of rock, afterwards becoming merged in Dubmill and Ellison scars, which at low-water uncovers to the distance of $2\frac{1}{4}$ miles off, described on page 404. Between Dubmill point and Silloth, a distance of $4\frac{1}{2}$ miles, the coast consists of a range of low sand-hills.

Anchorage.—The southern portion of Allonby bay affords good anchorage for small craft, with off-shore winds in $2\frac{1}{2}$ to 3 fathoms, but Allonby church should not be brought to the southward of E. by S. $\frac{1}{2}$ S. on account of the rough and rotten ground (boulders, and aggregations of the sandy tubes of worms), which extends out from and skirts Dubmill scar. There is very little stream of tide in this bay after one-third ebb, owing to the uncovering of the flats from Dubmill point at that period of the tide.

SAND BANKS.—Approach to Maryport and Silloth.—The whole of the firth of Solway is more or less occupied by extensive sand banks, having between them channels of deep water which are subject to frequent change, for which reason it is advisable to employ the services of a pilot if proceeding above Maryport.

English channel, and its continuation upwards under various names, is the only one which is lighted and buoyed. The sands, as they occur, proceeding in from seaward are as follows :—

Workington bank, with a least depth of 16 feet, lies abreast Workington, in the fairway of the approach to Maryport and Silloth, and forms the north-west side of English channel, the passage between it and Workington with depths of 9 fathoms. The bank is 3 miles in length in a N.N.E. and S.S.W. direction, between the 5-fathoms limit, and composed of fine sand ; within the depth

of 3 fathoms it is 6 cables in length, and from its centre Workington pier light bears S.E. by E. $\frac{3}{4}$ E., distant $2\frac{1}{2}$ miles. Isolated patches of 3 fathoms lie southward of this portion of the bank, but within the 5-fathoms limit. There is a heavy sea on this bank in bad weather.

Three-fathoms bank, situated about one mile northward of Workington bank, was found, by the survey of 1876, to have as little as 10 feet water towards its centre, over a distance of half a mile; within a depth of 3 fathoms it is $1\frac{1}{2}$ miles in length, by 3 cables in breadth. From the centre of the shallow water, Workington light-house bears S.S.E. $\frac{1}{4}$ E., distant $3\frac{6}{10}$ miles. There is from 6 to 9 fathoms in that part of English channel within it. During the ebb in westerly winds, there is a great overfall about this bank, from the stream setting obliquely over it.

Clearing mark.—The dome of St. John's church, the upper church at Workington, kept in line with Workington pier light, S.E., leads between Workington and Three-fathoms bank, in about 4 fathoms water.

Two-feet bank is the name given to the south-west tongue, with depths of 7 to 18 feet, of the large masses of sand banks, which occupy the middle portion of the Firth. From this tongue the south edge of the bank trends east and north-east to Robin Rigg sand.

Buoy.—A red and white, horizontally striped spherical buoy, surmounted by staff and diamond, in 4 fathoms, lies about one cable from the south-west extreme of Two-feet bank, with Maryport pier light E. by S. $\frac{1}{2}$ S., distant 8 miles, and Abbey head N.W. $\frac{1}{4}$ N.

The buoys and beacons within this belong to the North British Railway Company.

The Screel, east peak of Bengarn, open westward of Great Aird hill led westward of Two-feet bank in 1876, the date of last survey. (View A on chart.) *See also p. 390.*

Robin Rigg and North banks.—Robin Rigg, situated about 6 or 7 miles north-eastward of Two-feet bank, and North bank situated north-eastward of Robin Rigg, are together about 10 miles in length, and dry considerably at certain times of tide; their configuration is so subject to change that no written description can be given.

Silloth bank is a long tongue of sand, dry in places at about Lalf tide, which lies between North bank and Silloth. Between it and North bank, is the Annan channel, which has opened in recent years; the former channel to Annan, eastward of Silloth bank, having closed

up. With the exception of a bank on the bar in the approach to Silloth, this completes the dangers on the north side of the channel.

Patches.—At the distance of $1\frac{1}{2}$ miles off Maryport, a narrow ridge about $2\frac{1}{2}$ miles in length, with depths of 14 to 18 feet, extends parallel to the shore (as mentioned on p. 399).

Ellison scar and Far sand bank, which dry about 5 feet and 2 feet, respectively, form the western and outer extreme of the flats which dry $2\frac{1}{4}$ miles off Dubmill point. From Far sand bank, the sands dry some distance southward of a line to Allonby church; and from Ellison scar, the low line runs directly for Lee scar, close to Silloth; this portion, about 4 miles in length, is known as the Beckfoot flats; Catherine scar, just within the low line, lies about midway.

APPROACH TO SILLOTH.—Bar.*—The Firth is barred between Ellison scar and Silloth bank, about $1\frac{1}{2}$ miles apart, by a sand ridge from a half to $1\frac{1}{2}$ miles in length, on the middle of which ridge are depths of about 7 feet; between this portion of the ridge and Ellison scar is the navigable channel to Silloth, with depths of about 9 feet at low-water springs, 29 feet at high-water neaps, and 35 feet at high-water springs. This channel is lighted and buoyed, but owing to the shifting nature of the banks the services of a pilot are advisable.

LIGHT-VESSEL.—From a light-vessel painted black, and moored in 4 fathoms westward of the foul ground off Dubmill point, is exhibited, at an elevation of 25 feet above the sea, a *fixed red* light, visible about 6 miles in clear weather. The vessel lies about 2 cables westward of the edge of the flats extending from Dubmill point, with Ellison scar E. by $N\frac{1}{4}N$. $1\frac{1}{10}$ miles; the fairway is westward of her. Leading lights for bar, *see* Silloth, p. 407.

Buoyage.—The starboard side of the channel, on entering, is marked by red conical buoys, and the port hand by black can, and are shifted to meet the changes in the channel. They are the property of the North British Railway Company, and are described here as they were placed in 1890.

A fairway buoy, painted in black and white horizontal stripes, lies in about 5 fathoms, with the light-vessel bearing N.E. distant $2\frac{4}{10}$ miles.

A black can buoy, with staff and ball, marked S. 1, lies in about 5 fathoms off the east edge of Robin Rigg sand, with the light-vessel E.N.E. about $1\frac{1}{4}$ miles.

* The channel from the Bar to a little above Silloth was re-sounded in the spring of 1890 by Staff Commander W. E. Archdeacon.

A red conical buoy, marked S. 1, lies about one mile E.S.E. of the black S. 1 buoy, near the south-west extreme of the flats extending from Dubmill point, about one mile S. by W. of the light-vessel.

S. 2, red conical, lies in 6 feet, 9 cables west of Ellison scar. S. 2, black can, in about $4\frac{1}{2}$ fathoms, lies half a mile W.N.W. of S. 2 red.

S. 3, red conical, in about 2 fathoms, marks the south side of the bar channel, about one mile N.E. of Ellison scar; S. 3, black can with cage, lies half a mile north-west of it.

S. 4, red conical, and S. 4, black can, lie one mile north-eastward of the last-mentioned, and mark the 3-fathoms edge of the channel on either side.

S. 5, conical red, and S. 5, conical black, in similar positions about three-quarters of a mile further north-eastward, at the west end of Catherine hole or Silloth road. (S. 5 black, is conical, as it is a starboard hand buoy for entering Annan channel from Silloth.)

Directions for English Channel to Maryport and Silloth.—Bound up the Solway, and having rounded St. Bees' head, which, from its well-marked character, is an excellent beacon for leading towards the Firth (*see* view on chart No. 1,346); keep from one to $1\frac{1}{2}$ miles off the shore, to abreast Workington, above which an offing of $1\frac{3}{4}$ to 2 miles, and a depth of not less than 5 fathoms, will clear the banks to Maryport, where anchorage may be taken in Maryport road, if not about to enter the harbour. *See* p. 399.

If working in, observe that the dome of St. John's, the upper church in Workington, in line with the lighthouse there, bearing S.E., will lead half a mile south-westward of Three-fathoms bank, in 4 fathoms water, and nearly the same distance northward of Workington bank.

To Silloth.—From abreast Maryport, the fairway buoy, with black and white horizontal stripes, marking the entrance of the channel to Silloth, will be seen, nearly in line with the light-vessel; steer to pass on either side of the buoy, thence westward of the light-vessel, with the red buoys on the starboard hand and black buoys on the port hand, crossing the bar, which has about 22 feet at half-tide and 35 feet at high-water springs, with Cote and Lee scar lighthouses in line; this mark will lead between the buoys to Catherine hole, the anchorage off Silloth, p. 406. From abreast Nos. 5 buoys, open Cote light northward of Lee scar light, to give the latter a berth of one cable.

If proceeding to Annan, the bar has not necessarily to be crossed; but from abreast the Solway light-vessel, steer to pass westward of S. 2 and S. 3 black can buoys, thence for Annan channel

No. 1, a black buoy with white top, in the fairway of the channel, thence from buoy to buoy, passing close to them. From Silloth, the Annan channel is entered between Nos. 4 and 5 black buoys in Silloth channel.

The passage to Annan is not available without local knowledge, owing to the rapidity of the tides and the shifting nature of the channel and therefore further directions are useless.

Anchorage.—Silloth road or Catherine hole affords sheltered anchorage in all winds, being protected by sand banks which dry at about half-ebb; the tidal streams run about 4 miles an hour at springs. The anchor may be let go anywhere between the upper buoys and Lee scar, in from 3 to 5 fathoms at low-water, over sand and clay. As the main stream of tide now takes the Annan channel, which has been gradually opening for many years, it is possible the depths in the Hole may alter.

In moderate weather, vessels may wait the tide abreast Allonby bay 2 miles below the light-vessel, in $3\frac{1}{2}$ to 4 fathoms.

SILLOTH WET DOCK.—Silloth, situated about 10 miles above Maryport, and 22 miles from Carlisle, had no existence previous to 1856, when the fact that this portion of the Solway offered shelter from all winds, led to the construction of a railway connecting it with Carlisle, and to the excavating of the Marshall dock, now the tidal basin, a new dock having been constructed in 1885 within it.

This dock, 6 acres in extent, is the property of the North British Railway Co. : it is 633 feet in length, 400 feet in breadth, 60 feet wide in the entrance, with a depth on sill of 24 feet at high-water springs. The tidal basin is about 4 acres in extent, with the same depth on sill as the dock, and is 95 feet wide in the entrance.

The dock is fitted with every appliance for the rapid discharge and ading of vessels; there is a hydraulic hoist for the shipment of coal, a 25-ton crane for the shipment of machinery, and four movable 2-ton cranes. The railway lines are laid on the quays, and sheds are provided for the storage of goods.

Depth in approach.—At 3 miles below Silloth is a bar with 9 feet least water, and 35 feet at high-water springs, p. 404, between which and Silloth there is anchorage in Catherine hole in depths of 3 to 5 fathoms at low-water, as before stated.

A large-linked chain lies on the north-east side of the entrance to Silloth dock, parallel to the wooden jetty, for the purpose of bringing up vessels obliged to anchor in the channel; it is marked at intervals by warping buoys.

LIGHTS.—**Lee scar.**—From a pile lighthouse, 45 feet in height, erected on Lee scar, situated near the edge of the low line, and 6 cables W.S.W. of Silloth pier, is exhibited, at an elevation of 25 feet above high-water springs, a *fixed white* light, visible from a distance of 10 miles in clear weather; being focussed for the bar channel it becomes dim towards Allonby bay.

Fog signal.—A bell is sounded during thick or foggy weather.

That part of Lee scar on which the lighthouse stands dries 10 feet at low-water ordinary springs; the channel side is steep-to.

Cote.—Near the coast, at one mile north-eastward of Silloth, is Cote or Skinburness lighthouse, a wooden framework 32 feet in height, painted white, from which is exhibited, at an elevation of 40 feet above high water, a *fixed red* light, visible in clear weather from a distance of 9 miles. It, with Lee scar light, forms the leading mark for the bar of the Solway, from 3 to 5 miles below Silloth.

Jetty and tidal signals.—From the wooden jetty, 1,000 feet in length, extending from near the entrance of the Silloth basin, to 300 yards within low-water mark, and having at its head a small building and flagstaff, is exhibited a *fixed yellow* light from sunset to sunrise, except when the dock gates are open, when a *fixed green* light is shown; a red ball hoisted on the staff by day also indicates the gates are open. Two *fixed red* lights exhibited at the head of the dock, kept in line, lead through the centre of the dock entrance.

Tides.—It is high-water, full and change, at Silloth at 11h. 40m. local, 11h. 53m. Greenwich time; springs rise 26 feet, and neaps 20 feet. At Lee scar is a tide gauge with large figures showing the depth of water in the entrance to the dock.

Directions.—See page 405.

Pilots and Steam-tugs.—Branch pilots can be obtained off Maryport; their boats carry three lug sails, with a number on them, and on the bows. A steam-tug is kept for towing vessels into and out of Silloth dock; she also takes vessels to and from Annan and occasionally assists others to Dumfries.

A lifeboat is stationed on the north side of Silloth dock.

Storm warnings are shown by day from the flagstaff at the basin entrance when such have been telegraphed.

Silloth.—The main street of Silloth runs parallel to the Firth, and is fronted by a green with a pavilion and baths. Christ church, with

its tall spire, is a conspicuous object, and the town possesses several good hotels, which are extensively patronised during the summer season.

Population in 1881 was 1,186.

Communication.—Trade.—The dock is connected by railway with Carlisle direct, and with the Glasgow and South-Western line by a branch across the Solway $7\frac{1}{2}$ miles above Silloth; there is almost daily steamer communication with Liverpool, and twice a week to the Isle of Man and Dublin.

Silloth is a creek of Carlisle custom-house; 1,083 vessels entered the dock in the year 1888, of the aggregate tonnage of 183,469 tons.

Supplies.—Water is supplied by hose, and all necessaries can be procured here or in a short time from Carlisle. Coaling is rapidly done.

COAST.—From Silloth to Skinburness, and Grune point the west point of Moricambe bay, the coast is very low and marshy, fronted by shingle and sand to the distance of about 2 cables.

Moricambe bay is about $1\frac{1}{2}$ miles wide in its entrance and about 2 miles in depth, the whole of which, and for 2 miles beyond it into the Firth, is dry at low-water springs, beyond which is the Powfoot channel. On these extensive sand flats, known as the Cardunock flats and Middle bank, are patches of stones, known as the Tickhill, Brow and West scars; others are now hidden by the shifting sand. The small rivers Waver and Wampool discharge into the bay; the Wampool entering it from the east under a bridge at the village of Kirkbride; the Waver crossed by a railway and road bridge on the south from near Abbey Holme. At springs the tide reaches far up this inlet, but it is fast filling up.

So uncertain are the sands as to position and shape, affected as they are by the freshes from the rivers, which discharge themselves at or near the head of the Firth, that it would be useless to attempt any description of the low-water features above Silloth road. English coast continued on p. 410.

RIVER ANNAN, on the Scotch side, about 8 miles above Silloth, rises on the south side of Hart fell, elevated 2,635 feet, near the junction of the three counties of Lanark, Peebles, and Dumfries, and flows in a southerly direction past Moffat and Lochmaben; then south-east and south, under Annan road and railway bridges, and from thence $1\frac{3}{4}$ mile to its junction with the Solway at Barnkirk point. The total length of the river is 30 miles, and it is swelled by

several tributaries, two of which, the Ae from the north-west, and the Moffat from the north-east, are famed for their falls, called "Greymares tails," one of 90 and the other of 300 feet.

The channel of the Annan runs close to Annan point. Immediately outside Annan-foot is a scar, to avoid which care must be observed if entering the river much before high water.

Vessels of 9 or 10 feet can ascend to the town quay at high-water. The Annan is crossed by a bridge of three arches $1\frac{3}{4}$ mile above Annan-foot, and there is a dam and a railway bridge a little below it. The general width of the river up to the bridge is about 100 yards.

Tidal light.—Barnkirk point, or Annan-foot, 50 feet in height, the south-west point of the outlet of the Annan, is one of the most prominent objects in the upper part of the Solway. On this stands the lighthouse from which is exhibited a *fixed white* light from half-flood to half-ebb. A flag is hoisted during the same period of tide by day.

Fog signal.—A bell is sounded during thick or foggy weather.

Tides.—At the mouth of the Annan, it is high-water, full and change, at 0h. 5m. local time ; springs rise $28\frac{1}{2}$ feet, and neaps 20 feet.

The flood runs 4 hours and the ebb 8 hours, with a velocity of 5 to 6 knots at springs.

Directions, *see* p. 405.

Annan is a royal burgh of very ancient date ; it is connected with the main lines of railway by Gretna, distant 8 miles ; the Solway junction to Maryport and Silloth ; northward to the Caledonian line by Kirtlebridge ; and to Dumfries, 15 miles.

The manufacture of cottons is carried on ; shipbuilding to a small extent, with rope works and salmon fishing, form the chief trade of the town ; it imports timber and slates, and exports agricultural produce. The custom-house returns of Annan are included in those from Dumfries, their being no officer stationed at it.

The population in 1881 was 3,366.

Coast.—From Annan-foot eastward to Dornock burn the distance is 2 miles, whence the coast trends out for the same distance south-east to Tordoff point. From Seafeld point, three-quarters of a mile from Annan-foot, the Solway junction railway, crosses the estuary in nearly a south direction for Bowness ; and from near Dornock there is a cart-ford to port Carlisle, $1\frac{1}{2}$ mile across.

From Tordoff point to Redkirk point is 2 miles, and from thence to Sarkfoot, $1\frac{1}{4}$ miles, the shore is low with a rising background, and

fronted by some shingle and sand. The Sark here divides England from Scotland, and one mile above the small bridge, which crosses it at one-third that distance from its marshy outlet, is the well-known Gretna Green.

BOWNESS AND PORT CARLISLE.—Returning to the English coast (p. 408). From abreast the village of Cardunock, a low coast trends easterly for three miles to the village of Bowness on a rising ground, which is also rendered conspicuous by a windmill near the extremity of the point. Half a mile below Bowness the Solway is crossed by the Solway junction railway, upon an iron pile viaduct three-quarters of a mile in length connecting with embankments from the shores, the total length between Bowness and the opposite point of Seafield being about $1\frac{1}{4}$ mile; it was opened in September, 1869. The navigation above this is now closed except to vessels with lowered masts.

One mile above Bowness is port Carlisle, which is formed by a long wooden pier with a cant partly filled in with rubble, to the north-westward, and by a stone covering pier to the south-eastward. A canal 14 miles long was formerly the channel of communication between this place and Carlisle, but it was filled up a few years since, and a railway laid along it: the basin, which still exists, has its outlet at the heel of the wooden pier.

This port is now abandoned in consequence of the above-mentioned viaduct across the navigation.

Tides.—It is high-water, full and change, at port Carlisle, at 0h. 10m. local time, or 56m. later than at Whitehaven. The flood, which runs for only 3 hours, attains a rate of 5 knots at springs.

At low-water there is a cart-ford to Dornock upon the opposite shore, a distance of $1\frac{1}{4}$ mile.

Sandsfield.—The shore sweeps south-easterly for 2 miles to the village of Drumburgh, where the Silloth railway joins that from port Carlisle; here the marsh lands commence, and extend about east for 3 miles to Burgh point, between which and Rockcliff marsh the river Eden winds out to its junction with the Firth. Sandsfield is above a mile beyond the point; it was the discharging place for small vessels before the canal to port Carlisle (now a railway) was opened, and the remains of its storehouses are yet standing. Near Sandsfield, upon the marsh, is a monument erected to the memory of Edward I.

RIVER EDEN enters the Solway at Sandsfield; it issues from the side of a hill in the Pennine range near the borders of Westmorland and Yorkshire, and pursues its winding northern course by

Kirkby-Stephen and Appleby, and receiving several smaller tributaries, enters Cumberland near its junction with the Eamont. The river is augmented by the Caldew from the south-west, having previously received the Irthing from the eastward; it is crossed by a handsome stone bridge at Carlisle; one mile below by the Caledonian railway, and half a mile below it, by that of the North British railway. It then flows on with a very winding course for 8 miles to its outlet at Burgh point, passing the villages Grimsdale, Beaumont, Rockcliff, and Sandsfield, at which latter place there is a ferry; the whole length of the river being about 65 miles.

The distance from Sandsfield to Carlisle bridge is 8 miles, and this portion of the river is not more than 200 to 300 feet wide.

Tidal limit.—The highest limit of an ordinary spring tide is about one-third of a mile above the village of Beaumont, or about 3 miles above Sandsfield.

CARLISLE is situated on the south bank of the Eden. At the north-west end of the city is its ancient castle restored and occupied by troops; at the opposite end is an extensive and castellated pile of buildings erected for court-houses and gaol, and on an eminence in the centre is the venerable cathedral. Cotton and other manufactures are carried on to a large extent. Carlisle is the Customs port of the district; the vessels belonging to it are mentioned with the trade of Silloth, the nearest harbour frequented by shipping. The population in 1881 was 35,866.

Rivers Esk and Sark.—The Esk is formed by the union of the White and Black Esks and many other streams, which have their source in the mountainous district of Eskdalemuir, and effect a junction at the King's pool below Bailliehill. From thence the river pursues its course to the town of Langholm 7 miles below; at Liddel Moat, near Canonbie, it is joined by Liddel water, which afterwards, with the Sark, divides England from Scotland. The Esk enters the Solway from under a road and a railway bridge, 2 miles above Sarkfoot point or the head of the estuary, and 38 miles from its source. The small river Sark enters the Firth half a mile northward from the outlet of the Esk, and both streams flow through shifting channels north of Rockcliff marsh to their junction with the Eden off Tordoff point. The ground between the two streams was formerly called the Debateable land, but it is now attached to England.

NORTHERN SHORE OF THE FIRTH.—Abbey head, the outer and north-west boundary of the firth of Solway, is a bold rocky headland, with depths of 5 to 6 fathoms within one cable

of the base of the cliffs. North-eastward, half a mile from the head, is Abbey Burnfoot, where is generally an ample stream of water. Small craft occasionally discharge lime and coal at the mouth of the Burn towards high water, but the operation is always attended by risk.

Tides.—It is high-water, full and change, at Abbey head, at 11h. 10m. local, 11h. 26m. Greenwich time; equinoctial springs rise 27 feet, ordinary springs 25 feet, neaps $18\frac{1}{2}$ feet, and the neap range is 12 feet.

COAST.—About one mile eastward of Abbey head, is Port Mary, a small bight with many rocky heads on the foreshore covered at high-water. At $1\frac{1}{4}$ mile farther eastward, at Barlocco, are some extensive caves into which the tide flows. Orraland bay, close eastward, is devoid of shelter, and encumbered by loose stones and shingle.

Castle Moor point has shelving rocks extending about a cable from it, and Rascarrel bay, of which it is the western boundary, is, like the other small indentures just noticed, unfit for shelter. Eastwards the shore is bolder to Aird and Balcary points. *See* view A., chart No. 1,346.

AUCHENCAIRN and HESTAN BAYS are the two heads of one inlet within Balcary point, and Almorness the western point of Urr water; Torr point being the central division. The whole inlet has a bottom of fine sand, which uncovers at low water. The village of Auchencairn is at the north-west part of Auchencairn bay, and 2 miles northward of it is Bengairn mountain, elevated 1,267 feet above high-water, and a conspicuous object from every part of the firth of Solway.

Balcary bay, in which many small coasting craft that can take the ground may find shelter in westerly and south-westerly winds, is immediately within Balcary point, at the south-west part of Auchencairn bay; Balcary house is at the head of it. The whole of the bay is dry at low water, but the bottom is a mixture of mud and sand, on which vessels lie securely.

In entering, round the point closely, leave the perches on the port hand, and luff into the bay towards Balcary house as near as the draught of the vessel and the direction of the wind will permit. With the wind off-shore, a small vessel may find snug anchorage between Balcary point and Hestan island in $1\frac{1}{2}$ to 2 fathoms at low-water springs. The tidal streams set strongly past all the points, but are slack immediately within the line joining them.

A Lifeboat is stationed in Balcary bay.

Hestan island, 162 feet in height, and the eastern boundary of the entrance to Auchencairn bay, is about one-third of a mile in length. A natural causeway of shingle connects the islet with Almorness, and until the water leaves this, which it does at about two-thirds ebb, the ebb stream sets over it directly for Balcary point, and, again, when it is covered the flood stream sets across it into the Urr. Hestan islet is steep-to on its seaward side.

Tides.—It is high water, full and change, at Balcary, at 11h. 15m. local time.

ROUGH FIRTH.—**Urr water** issues from loch Urr, a small lake between Dumfriesshire and Kirkcudbrightshire, and, augmented by several streams from similar lakes, runs for 26 miles to its estuary, Rough firth, thence into the Solway.

Rough island, 62 feet high, near the middle of Rough firth, is one-quarter of a mile in length, and connected to the shore by a causeway.

Palnackie.—The mouth of the Urr, at the head of Rough firth, is about 2 cables wide abreast the village of Kippford, whence the river winds for 2 miles to the small shipping place of Palnackie, where it is only 250 feet wide. A small tidal dock here admits vessels of 14 feet draught, at high-water springs; the flood stream runs up at the rate of $3\frac{1}{2}$ knots.

Hass.—From Palnackie the Urr continues with an average width of 100 feet for $2\frac{1}{2}$ miles to the port or Dub of Hass. Some large patches of rock between the mansion of Munches and the port of Hass, greatly obstruct the navigation; the channel in their vicinity is only 50 feet wide. Vessels of 9 feet draught can reach the place at high-water springs.

At the port of Hass, it is high-water, full and change, at 12h. 0m.; springs rise 9 feet. The flood stream runs only for 2 hours.

The village of Dalbeaty, with a population of about 3,000, is about half a mile above Hass; small vessels can at times reach it.

There is a considerable coast traffic up Urr water; Palnackie or Barlochan is a creek of Dumfries.

Gibbs hole, a bight on the west side of Rough firth, southward of Castle hill, is a pool said to have depths of 10 to 12 feet at low-water, with good holding ground, and to be secure except in gales from the south-eastward, when a heavy sea sets in after half-flood, the banks being well covered. It may be entered by small craft at about half-flood, when apparently there will be a depth of about 10 feet water in the entrance to Rough firth. The channel is close off Castle head with South Glen hill in line with the east side of

Rough island, which mark also leads westward of Craig Roan, a ledge which dries 19 feet at low-water springs, extending 3 cables off-shore eastward of Castle point. Having approached Rough island to the distance of 2 cables, pass westward of it, and haul over to the western shore to Gibbs hole.

BARNHOURIE SAND, fronts the whole coast from between a point situated nearly one mile eastward of Rough firth, and Southerness, to the distance of $1\frac{1}{2}$ miles in places; this distance is increased to nearly 6 miles in a W.S.W. direction from Southerness, drying in places 7 to 10 feet at low-water springs. On its south-east side is Scotch deep, and its continuation above, Dumfries channel.

Porthing bay, an indentation in the coast, one mile eastward of Rough firth, is dry at low water, and affords no protection; Whitehill, a prominent object 456 feet above high water, lies within it.

Douglas bay, one mile within Porthing bay, is a bight of little importance, situated $1\frac{1}{2}$ miles within the edge of the sands, which dry at low water. Very small vessels, in fine weather, may enter at high water, and lie aground.

Southwick water, a small stream, discharges its water at the head of the bay, northward of Douglas bay, whence the hills gradually rise to Criffel hill, 1,852 feet in height, and distant about 4 miles, a prominent feature in every direction. Southward of these hills the ground gradually slopes to the low shore at Southerness and Barrow point.

SOUTHERNESS is the south-eastern projection of the tract of low land named the Merse, having the village of Southerness, consisting of a few cottages, close within. A square tower, formerly a lighthouse, stands at the high-water extreme of the point.

Ledges of rock front the point to the distance of 2 cables, and the shore eastward to half a mile; farther eastward the low line of sand dries off one mile; here, also, the Dumfries channel is almost dry in places. Two patches, which dry 8 feet at low-water springs, and are detached from the low-water margin, are named the Spring stones, from which the old lighthouse bears West, distant 6 cables.

From Southerness, the shore trends north-eastward about 2 miles to Burron point, and is low, with high trees to the northward of the mansion of Arbigland, half a mile from the coast. From Burron point the coast turns northerly to Aird point, entrance to the Nith, distant $4\frac{1}{2}$ miles.

Carsethorn village.—At one mile north of Burron point, is a jetty for the use of steamers during neaps, when they cannot ascend

higher up the Nith; perch beacons mark the scars south-eastward of the pier.

RIVER NITH is the largest river of Dumfriesshire. Vessels of 15 feet draught can reach Glencaple quay, 5 miles below Dumfries, at high-water springs; and those of 10 feet reach New, or Kingholm quay, on the east side, where there is a small tidal dock, $1\frac{1}{2}$ miles below Dumfries; small craft can reach Dumfries at springs. The steamer trading to the Nith goes up to Glencaple quay at springs, but does not come above Carsethorn at neaps, as before mentioned.

From Aird point, the river is partly confined on the west side by an embankment, which is continued to abreast Conheath, half a mile above Glencaple quay, and which is covered when there is 9 feet of water in the channel; upon the embankment are perches with cross tops, and on the eastern side of the channel are perches with brooms. At 2 miles above Glencaple is Netherwood, where the embankments have not unfrequently been submerged at high-water spring tides; the river here is 400 yards wide, but the channel, hitherto sand, is encumbered by several patches of gravel.

Above Netherwood merse, the river is only 100 yards wide, but its channel has been improved by confining and straightening its course. The tide does not flow above the old bridge of Dumfries.

The Nith rises on the north sides of Knife hill, elevated 1,260 feet, and Benhain hills on the border of Ayrshire. After passing the village of New Cumnock and receiving Connal burn and Afton water, it enters Dumfriesshire, and from the boundary flows east and south-east for 20 miles, till it is joined by the Skaar, having passed westward of the towns of Sanquhar and Thornhill. It then continues $11\frac{1}{2}$ miles south-eastward, to a point near the confluence with it of the Carin from the westward, and making a bold sweep westward round the town of Dumfries, runs nearly due south $6\frac{1}{2}$ miles to its entrance, where it unites with the Firth of Solway. Exclusive of all minor bends and windings, it has altogether a course of about 50 miles.

Tides.—It is high-water, full and change, at Southernness, at 11h. 50m. local, 12h. 4m. Greenwich time, and at Dumfries 10 minutes later. At Southernness the rise at springs is $27\frac{1}{2}$ feet, and of neaps $19\frac{1}{2}$ feet; springs rise 6 feet at Dumfries.

Pilots.—Nith pilots can be procured at Carsethorn and Glencaple; strangers should call at Kirkcudbright, and send from there for a pilot,

Directions.—No directions for the Nith would be of any avail, for the channel across the flats from Southernness to Glencaple quay is shallow, winding, and changeable.

DUMFRIES, a royal burgh and county town, though a place having comparatively little trade, is of considerable magnitude, and one of the most important in the south of Scotland. The scenery surrounding it is noted for its great beauty, and includes several extensive ruins, Lincluden abbey, New abbey, and Caerlaverock castle. The river is crossed by three bridges, a railway, a road, and a footbridge, the latter a very ancient structure, having originally 13 arches, and at the time considered second only to old London bridge; it has now but 6 arches, and is used for foot passengers only.

Trade, &c.—From Dumfries there is direct communication by railway to all parts of the United Kingdom. There are but few manufactures, the chief being cotton goods and shoes; the exports, agricultural produce; and the imports, timber, iron, and coal.

About 550 coasters, of the aggregate tonnage of 26,000 tons, enter and leave annually. Number of vessels belonging to the port, about 40, of an average of 90 tons.

The population in 1881 was 17,090.

Coast.—From the entrance of the Nith the low shore trends eastward for $3\frac{1}{2}$ miles to the outlet of the Lochar, a small stream running parallel with the Nith. A little back from the coast are the ruins of Caerlaverock castle, surrounded by wood. Near the mouth of the Lochar the coast is very flat, and from the rivulet being subject to freshes, the flats and sand are often liable to change; the fall also from several miles inland is so gentle as to render it a difficult matter to establish any efficient drainage for the bordering marshes. From the Lochar to Barnkirk point, or Annan foot, the general direction is south-east, and the distance $6\frac{1}{2}$ miles, Priestwoodside moss or marsh occupying a large portion of the land within the coast-line; about midway is the village of Cummertrees, on a rise situated about half a mile back from the coast. For Annan and coast above, *see* page 408.

SANDBANKS and CHANNELS on north shore.—The channels between the several shifting sandbanks off the Scotch shore of the Firth are not buoyed, and as leading marks cannot be given, directions would be useless; the following banks and channels existed in 1876, the date of last survey; the depths will be seen on the chart.

Barnhowrie sand, which extends about 5 miles south-westward of Southerness, has already been mentioned, page 414.

Dumroof bank occupies nearly the whole of the space between Two-foot bank and Robin Rigg, and the extension under water of Barnhowrie sand; its outer extreme is about 10 miles south-westward of Southerness; patches in places are dry a few feet at low water. The channel southward of Dumroof is known as Middle channel.

Dumfries channel is the continuation north-eastward of Middle channel, and is confined to that portion between Southerness and the entrance to the Nith; some portions of it dry towards low water.

The Blackshaw flats and spit form the eastern boundary of the entrance to the Nith, the extreme of the spit being 4 miles southward of the entrance points.

Barbara and Powfoot channels are the continuation of the Middle channel to Annan; vessels bound to Annan take the English and Annan channels, south side of the Firth.

For tides and streams on the Scotch shore, *see* pp. 391, 412, 415.

COAST.—From Abbey head (page 411) a bold rocky coast trends westward for $2\frac{1}{2}$ miles to Balmae head; it is free from danger beyond a distance of 2 cables.

LITTLE ROSS ISLAND,* situated about 4 miles westward of Abbey head, and on the west side of the entrance to the estuary of the Dee, is about a quarter of a mile in extent, and separated by a channel named the Sound, 2 cables in width, from the peninsula of Great Ross, which is 272 feet in height. About midway in this channel is Richardson rock, above high water, between which and Little Ross there is a depth of one fathom at low-water springs; but this channel should only be used after half-flood, and by those locally acquainted. The island is fringed by a ledge to about one-third of a cable, with deep water close-to on its seaward sides.

LIGHT.—From a white lighthouse, 65 feet in height, erected on Little Ross, is exhibited, at an elevation of 175 feet above high water, a *flashing white light every five seconds*, visible in clear weather from a distance of 18 miles. A pyramid beacon stands about 150 yards north-eastward of it.

KIRKCUDBRIGHT BAY,* the estuary of the Dee, lies between Balmaes head and Little Ross island, separated by a

* *See* Admiralty plan of Kirkcudbright, No. 1,979, scale, $m = 3$ miles; and chart of lough Carlingford to lough Larne, No. 45.

distance of $1\frac{1}{2}$ miles, within which points the estuary extends for 3 miles northward, with an average width of one mile; at its head the estuary is divided by St. Mary's peninsula, formerly an island, and still known as such. For about 2 miles from its head the estuary is occupied by the Millton and Manxman sands, dry 2 to 4 feet at low-water springs, between which the Dee discharges its water through a channel one cable in width, with a least depth of 2 feet, thence taking a direction close along the eastern shore.

Frenchman rock, dry 6 feet at low-water springs, lies about 2 cables off the west shore, at $1\frac{1}{2}$ miles within Little Ross; but it is scarcely a danger, as the fairway is close along the eastern shore of the bay. The pile on the summit of Great Ross open of Barr point leads eastward, and Balmae head open of Torr point leads southward of it.

The **eastern shore** of the bay from Balmae head, is fringed by a ledge to the distance of 150 yards in places, and within the Manxman sands, to the distance of one cable, its extreme being marked, between Torr house and Torr lake, by three perches.

St. Mary's isle, now connected with the mainland, extends southward for one mile into the middle of the estuary; it is covered by much fine wood, and has on it a residence of the Earl of Selkirk. A wooded islet, named the Inch, lies about one cable off its south extreme; a low-water ledge, extending 2 cables south-west from the islet, is marked by a perch on its extreme, close to which is the channel of the river.

Buoys.—Two black buoys mark the eastern edge of Millton sands, in about 3 feet at low-water, and also mark the west side of the Dee channel; the perches on the eastern side have already been mentioned.

Two perches erected on the western shore, abreast St. Mary's isle, kept in line, bearing N. $\frac{1}{4}$ W., lead in the fairway eastward of the buoys.

Anchorage.—Kirkcudbright bay affords anchorage in 3 fathoms at low-water springs, good holding ground, midway between Little Ross and Torr point, sheltered from winds between W.S.W. through north to E.S.E.; and there are no dangers in the approach.

With winds from the southward of those mentioned, an uneasy swell sets in, and with south-west winds the anchorage is untenable. Coasters find shelter during south-west gales in Balmangan bay, half a mile within Little Ross island; here they lie aground at low-water, and moored to rings in the rocks.

The favourite place for coasters is on the Manxman sands, within the bar, where coasters lie aground in security, on a bottom of sand and mud. There is also a pool in the river, with a depth of 2 fathoms, abreast St. Mary's isle, known as Fish pool.

Lifeboat.—There is a lifeboat at Kirkcudbright town.

River Dee.—Kirkcudbright.—Vessels of 14 feet draught can reach Kirkcudbright, situated about 3 miles above the bar, at high-water springs, and those of 8 feet at neaps; here they lie aground in a camber 200 feet in length by 80 feet in breadth, and dry 6 feet at low-water springs.

The river entrance between St. Mary's isle and the west shore is 3 cables in breadth, but with the exception of Fish pool, with 2 fathoms at low water, it is here almost barred by a stony ledge extending from the island; abreast the town it is about 150 yards in width.

Above Kirkcudbright the river winds for $1\frac{1}{4}$ miles to near the ruin of Cumston castle on the right bank, where it divides; the northern stream or Tarf passing under a bridge at the Red Crae, half a mile up, the Dee continuing to the eastward under the bridge at Tongueland, $1\frac{1}{2}$ mile above Kirkcudbright, up to which point small craft reach at high-water. The river from its source to its entrance is 46 miles in length, and is noted for its salmon fishery.

The bar, with about 2 feet at low-water springs, 13 feet at half-tide, and 25 feet at high-water springs, commences about three-quarters of a mile within Torr point on the eastern shore; a perch marks the low line here. Within the bar, there is a depth of about one fathom at low water to Kirkcudbright.

South-west winds cause the highest sea on the bar; with southerly winds it is more protected, and with easterly winds the bar and the anchorage off it is smooth.

Light.—A *fixed red* light is exhibited from the east pier head of the camber, at Kirkcudbright.

Tides.—It is high-water, full and change, at Kirkcudbright, at 11h. 10m. local time; springs rise 23 feet, and neaps 17 feet. The flood stream reaches Kirkcudbright $1\frac{1}{2}$ hours after low-water in the bay. At Tongueland bridge, $1\frac{1}{2}$ miles above, the tide is 10 minutes later, and the spring rise is 15 feet; the tide extends to half a mile above it. Off the bay, the indraught of the flood will be felt at about one mile distant, where the general coast tide runs 4 knots at springs and 2 knots at neaps. Up the channel of the Dee the strength of the tide is $3\frac{1}{2}$ knots at springs, much influenced, however, by freshes.

Directions.—When the state of the tide permits of crossing the bar, and having rounded Little Ross at the distance of 2 or 3 cables, steer to pass within 2 cables of the shore within Torr point, keeping Ross lighthouse open eastward of the pyramid beacon north-eastward of it to avoid the tail of Millton sands. Thence within 50 yards of the outer perch, and between it and the outer black buoy, when the beacons near the fish house, will be seen in line bearing N. $\frac{1}{4}$ W.; steer for these, passing westward of the perch on the ledge extending from St. Mary's isle, until within a cable of the outer one; above this the channel to Kirkcudbright is not beacons, and local knowledge is necessary.

If intending to beach on Manxman sands, known also as Torr lake, it is only necessary to keep the perches on the starboard hand, beaching where advisable.

Town.—Kirkcudbright, a royal borough, stands low on the eastern bank of the Dee, $4\frac{1}{2}$ miles above Little Ross isle, and is a well and regularly built town.

Over the river a little above the harbour there is a level bridge on iron piles admitting the passage of vessels to Tongueland.

Kirkcudbright is connected with the Caledonian and Glasgow and South Western Railways by a line to Castle Douglas, $10\frac{1}{2}$ miles, and is distant from Dumfries 30 miles, and from Stranraer and Portpatrick $63\frac{1}{2}$ and 70 miles. It is a creek of Dumfries.

The population in 1881 was 2,571.

Trade.—The exports is principally grain to the value of £2,000, the imports are coal, lime, &c. About 90 vessels visit the port annually, of the aggregate tonnage of 5,000 tons.

WIGTON BAY,* is contained between Great Ross and Burrow head, separated by a distance of 12 miles. The bay is 13 miles deep to the narrows at Knockdown ferry, or 8 miles to the Wigton and Baldoon sands, dry at low water, which fill up the inner portion of it; and below which no banks or dangers exist, except within a short distance of the shore on either side.

General Directions.—In Wigton bay the bottom is clean and the depths are regular, decreasing gradually from 16 and 14 fathoms over sand, from the line between the heads, to 3 or 2 fathoms near Wigton sands. The various anchorages around the bay afford good shelter in off-shore winds, but a heavy sea sets into it with southerly winds, which are very prevalent, and often give but little warning. A sailing vessel caught suddenly under such circumstances within

* See Admiralty chart :—Lough Carlingford to lough Larne, No. 45.

the bay, should endeavour by every means to hang off until tide-time, and then enter Garliestown or the river Cree, as may appear most desirable.

By keeping southward of the line passing through Borgue church and Barlocco island, a vessel will be in not less than 3 fathoms, and nearly one mile southward of Wigton sands.

Tidal streams.—In the offing, the stream is slack for about an hour, near high and low water by the shore and at Liverpool; running eastward whilst the tide is rising, and westward whilst it is falling at Liverpool.

The flood stream begins to set into Wigton bay round Burrow head 2 hours before it is low-water by the shore, and about 2 hours before low water at entrance to Liverpool, taking a direction across the bay towards Muncraig bay or the Borgue land; but eastward of the centre of the bay, the direction is more south-easterly, towards Great Ross point.

Within the line of the heads the ebb stream sets to the westward across the bay 2 hours before it is high-water by the shore. The greatest velocity is 4 knots on springs and 2 knots on neaps.

The flood stream sets into the river Cree after one hour of flood by the shore; abreast Creetown it continues 5 hours, and the ebb stream 7 hours, the average rate being 5 knots on springs and 3 knots during neaps.

The above times are materially influenced by the wind, and above Creetown the strength is also affected by the river freshes.

It is high water, full and change, on the Wigton sands at 11h. 30m. local, 11h. 44m. Greenwich time. *See* tidal rise, pp. 424, 425.

EASTERN SHORE.—Bridgehouse bay.—The coast from Great Ross point trends irregularly north-westward for $2\frac{1}{2}$ miles to Bareness point; between is Bridgehouse bay, about 2 cables wide, half a mile deep, and dry at low water; it is fringed by shelving rocks, which, off the west point extend rather more than a cable; on the east side is a jetty, where, in fine weather, coasters discharge coal and lime. From Bareness a bold rocky coast, steep-to, especially at Muncraig heughs, extends northward to Kirkandrews bay.

Kirkandrews bay, 4 miles north-westward of Great Ross point, is fronted by ledges to the distance of a quarter of a mile, and is unfit for anchorage, except in off-shore winds.

Islands of Fleet.—Barlocco island, the southernmost of a group of four, designated the islands of Fleet, lies on the north side of Kirkandrews bay; it is connected to the rugged coast by rocks,

which uncover at low-water. The isle is 25 feet in height, one-quarter mile in extent, and the same distance from the coast, but the passage between is available for boats only at high water.

Knockbrev bay lies between Barlocco and Ardwall (Knockbrev) islands ; at low water the margin is sandy, but the high-water line is rock. Fair anchorage may be found in this bay with the wind off the land in $2\frac{1}{2}$ fathoms, sand. Ardwall island is nearly one-third of a mile in length, by one-quarter of a mile in breadth, with an elevation of 100 feet, and is connected to the main at low-water by a sand ridge ; there is a house near its south-west end. On the north side some rocks, named Parton Craigs, show at low water.

Murray isles lie half a mile north-westward of Ardwall island ; the north and larger island is one-quarter of a mile in length by 200 yards in width, and is connected with the sands of Fleet bay at low water.

The bay between Ardwall island and the Murray isles affords good anchorage for coasters, in 2 fathoms, during off-shore winds.

FLEET BAY is contained between the north point of Ardwall isle and Ringdow point, an opening $1\frac{1}{4}$ miles across, dry at low water. Within Airds bay, on the eastern side, Fleet bay becomes contracted to half a mile in width, and can be forded, while a large stone on the north margin of the stream is visible. Eastward of Rough point, situated one mile within Airds bay, is the beginning of an embankment, which, at the distance of half a mile within, with a similar work on the north side, contracts the stream to a width of 40 feet. Half a mile farther in, and at the same distance below Gatehouse bridge, is the shipping place.

Ringdow point, the north-west point of entrance to the bay, is fronted by Carvellan rocks at the distance of $1\frac{1}{2}$ cables, the heads of which are above high-water. At $1\frac{1}{2}$ miles within is Cardonness point and obelisk, and Skyre Burn bay, thence the bay is contracted as before stated.

The whole of Fleet bay, with the exception of the narrow and muddy channel of the issuing stream, is dry at low-water within the line of the entrance points. The mark for the deepest water is the north point of Airds bay bearing about N.E. by E. Vessels drawing 12 feet can reach the shipping place at high-water springs, but none should attempt to enter before two-thirds flood.

Tides.—It is high-water, full and change, at 11h. 15m. local time.

Fleetwater and Gatehouse.—Fleetwater has its source in two streams, the larger one on the east side of a hill named the Cairns Muir of Fleet, which in a direct line is about 10 miles northward from Gatehouse. The town of Gatehouse, which is a borough, is situated upon the eastern side of the water, which is crossed by a stone bridge; vessels of about 60 tons get up the embanked channel.

The trade is small, being confined to a few cargoes of coal and lime.

The population in 1871 was 1,503. The nearest railway station is about 5 miles off.

Coast.—From Ringdow, the rocky coast trends north-westward for $3\frac{1}{2}$ miles to Carsluith burn; the land is high, generally well wooded, and backed by a range of lofty hills, the highest of which is Cairnharrow, 1,487 feet in height. Near Ravenshill cliff is the conspicuous mansion of Kirkdale, and westward of it is the ruin of Carsluith castle, almost hidden by trees. The best channel into the Cree river is along this shore, which is free from danger beyond the distance of a cable.

From Carsluith burn the shore is low, with a stony margin and a high background, to the granite quarries, where is a projection formed from the refuse of the works. Abreast is a pool with 9 or 10 feet at low-water. The low-water channel, which runs close in to the shore, is about 100 yards wide, and is bounded westward by the Wigton sands.

CREETOWN, or Ferrytown-on-Cree, is situated near a bight one mile above the quarries, having on an eminence at its south end a church with a square tower. The channel, apparently dry at low-water in places, passes close to the sward in front of the town, thence obliquely to the Wigton shore. Vessels of 12 feet draught can reach Creetown at high-water springs. The flood stream runs for about 4 hours here.

A ferry-boat crosses to Wigton when tide permits.

Creetown is a station on the Caledonian railway; the population (in 1881) was 979.

From Creetown, the shore, passing the woods of Barholm, trends northerly one mile to Knockdown ferry, where the shores of the river Cree are only one-quarter of a mile apart. The ferry is abreast a pool having three fathoms at low-water, and extending half a mile above and below the ferry-house, with a width of 100 yards, and very steep shores.

The rate of the tide stream near the ferry is at times 5 to 6 knots.

River Cree, which may be said to join the sea at Knockdown ferry, rises in two streams; the one known as Cree proper, from Loch

Dornal, is small ; the other near Eldrick hill in Ayrshire, a direct distance of 18 miles from the town of Newton Stewart.

Salmon abound in the river, and in the month of March the smelt is also taken in it.

For the approach to this river, see remarks upon Wigton sands, page 427.

Palnure, 2 miles above Knockdown ferry, is half a mile up a tributary of the Cree ; it is crossed by a bridge, near which is a shipping-place admitting vessels drawing 12 feet at high-water springs, and 6 feet at neaps.

Carty quay.—Above Palnure creek the Cree river trends westward one mile with a width of 150 yards to Carty quay on the western bank. This, the uppermost shipping-place upon the Cree, may be reached by vessels of 12 feet draught at high-water springs ; and 6 feet at high-water neaps.

A little above Carty quay the river is crossed by the Caledonian railway, and the stream, narrow and with steep muddy shores, winds for 3 miles to the bridge of Newton Stewart.

Tides.—At Carty quay it is high-water, full and change, at 12h. 0m. local time. Springs rise 12 feet, neaps 6 feet. The tidal stream reaches about two miles above this, or within one mile of Newton Stewart.

Newton Stewart is situated upon the river Cree, which is here crossed by a bridge.

The population in 1871 was 2,873, chiefly engaged in the manufacture of leather, and hand loom weaving.

WESTERN SHORE.—**Burrow head**, the western point of entrance to Wigton bay, forming also the eastern point of Luce bay, is a conspicuous cliff from every direction seaward, and steep-to. There is a heavy race off it, however, when the ebb is opposed by a strong westerly wind.

From Burrow head a steep rocky shore extends $1\frac{1}{2}$ miles north-eastward to the entrance of Whithorn.

PORT WHITHORN is dry 3 feet at its entrance at low-water springs, but at half-tide vessels of 8 or 9 feet may enter and lie alongside the pier on the island side ; there is a depth of 18 feet in the entrance at high-water springs, and 10 feet at neaps.

The port is a good one for small craft, and the best on this coast, as it affords earlier access as well as greater depth of water than the others ; it is capable of holding a number of small vessels.

Isle of Whithorn, so named from having once been an island, though it is now connected with the main, is a conspicuous little promontory, rendered more so by a white tower on its summit, the base of which is about 40 feet above high-water. The isle forms the eastern side of port Whithorn, which is about one-sixth of a mile wide, with a rocky foreshore, besides being rather foul on the western side of the entrance, where a ledge projects, dry at low water.

Screen rocks.—Beacon.—Two small detached masses, named the Screen rocks, a short distance beyond the low-water margin on the west side of entrance, appear at the last-quarter ebb; they are steep-to, and marked by an iron beacon coloured red. Cairnharrow hill, open eastward of Stein head, leads well outside them.

Tides.—It is high-water, full and change, at Whithorn, at 11h. 5m. local time; ordinary springs rise 21 feet, and neaps 16 feet.

Directions.—There is anchorage off the port in $2\frac{1}{2}$ to 4 fathoms, sand, with the highest house in the village in line with the end of the pier.

In making for it, the Screen rocks should be given a berth during ebb tide, as the stream sets towards them; a heavy sea sets into the bay with southerly winds.

Lifeboat.—A lifeboat is stationed at port Whithorn.

Port Whithorn is a creek of Wigton. The population of the parish in 1881 was 352; it is 3 miles south-east of the royal burgh of Whithorn, and contains the ruins of a very ancient church.

A few vessels are here built and repaired; small supplies may be procured at the village.

Coast.—Stein head, 150 feet in height, situated half a mile northward of port Whithorn, is a bold headland, fringed by rocks to the distance of one cable, and which skirt the shore to Yerrock bay.

YERROCK BAY or port, immediately northward of Cairn head or Yerrock point, affords good shelter from westerly winds in 3 to 5 fathoms, sand; and there is cover for small craft farther in, from winds as far round as South, with which wind the anchorage in Garliestown bay to the northward is quite exposed.

Coast.—Between Yerrock bay and Rigg bay, 3 miles to the northward, there is good anchorage during westerly winds in 6 to 7 fathoms, sand, nearly clear of the influence of the tidal streams.

Port Allan.—About one mile northward from Yerrock bay is the small indenture of port Allan, north-easterly one mile from which is a bold point with the conspicuous ruin of Cruggilton castle on its summit; thence to Rigg bay the coast is clifty.

RIGG BAY is nearly half a mile wide and deep, with a thickly wooded shore. In the centre of the bay the bottom is sand, but the south and north points are foul, particularly the latter, from which rocks extend S.S.E. one-quarter of a mile, several heads always showing above water. Between the north point of Rigg bay and Garliestown pier, half a mile to the northward, are the ornamental grounds of Galloway house.

GARLIESTOWN lies on the west side of an inlet half a mile wide and deep, but dry at low-water; it is protected from north and north-east winds by Eggerness, which is clear of danger beyond the distance of one cable.

The bottom of the inlet is mostly sand and stones, but the western portion is large stones and rock. A perch marks a rocky patch, on the western side, with several large stones outside it that dry at low-water.

In the middle of the bay, about half a cable outside the low-water margin, is a small rock which dries 2 feet at low-water springs; there is 8 or 9 feet at low-water between it and Eggerness, and 3 to 4 feet between it and the low line off the pier; the rock is not marked, as it is not dangerous to vessels going alongside the pier, as there is always more water over it than there is at the pier.

Garliestown pier, 760 yards in length and dry 4 feet at its head at low-water springs, has a depth alongside the outer half of it of 17 to 20 feet at high-water springs, and 12 to 15 feet at neaps. The space enclosed is sufficient for the berthage of about 20 vessels, and there is a crane on the pier equal to lifting 3 tons.

When a vessel is expected, or observed off the harbour, a light is exhibited at night and a flag in daytime from the head of the pier.

In approaching the pier, pass half a cable outside the perch near it.

Anchorage.—In off-shore winds, good anchorage will be found at half a mile south-eastward of the pier, but, as is the case with the other roadsteads on the west side of Wigton bay, a heavy swell is sent home in southerly and south-easterly winds.

Trade.—Several vessels belong to the port, the trade of which consists principally of imports of coal, lime, manure and timber, and exports of grain, cattle and fish. A steam-vessel trades between Liverpool and Garliestown every fortnight. Two or three vessels from the Baltic or North America discharge timber here annually.

Garliestown is a creek of Wigton custom-house; the population (1881) was about 700.

Port Innerwell or McGean.—From Eggerness a rocky and well-wooded shore extends one mile northward to Innerwell point, within which is port Innerwell, where is a considerable salmon fishery. Thence the coast, still well-wooded, trends north-westerly for 2 miles to Orchardtown bay, when, assuming a flatter character, it trends northward for $2\frac{1}{2}$ miles to the outlet of Bladenoch river near the town of Wigton.

WIGTON SANDS, dry at low-water, occupy the whole of the space within a line joining Innerwell point and Carsluith castle on the opposite shore, with shallow water extending some 2 miles south-eastward of this line, in places.

Clearing mark.—**Directions.**—No sailing vessel waiting the tide to enter Cree river should go within the line of Borgue church over the north end of Barlocco island, bearing E. by S. $\frac{1}{4}$ S., on which there are depths of about 3 fathoms. As the nature of the shores at the head of Wigton bay do not admit of any distinct leading marks being given, vessels drawing 8 or 9 feet should wait until after half-flood before attempting to enter the Cree.

As stated (pp. 423, 424), vessels of 12 feet draught in charge of a pilot can navigate to Creetown and Carty quay at high-water springs, and those of 6 feet at neaps.

WIGTON, a royal burgh and also a county town, stands in a commanding situation upon an eminence, the white steeple of its gaol being a conspicuous object. The population in 1881 was 1,722.

Wigton is by the road $7\frac{1}{4}$ miles from Newton Stewart, which is the nearest railway station; it has no manufactures, and the trade consists in the supply of an agricultural district and the export of its produce. There is steam communication about once a fortnight with Liverpool and ports on the Galloway coast. Wigton is a custom-house port, and the returns for its district are about 550 coasters inwards of the aggregate tonnage of 29,000 tons, and the same amount outwards. Wigton alone (1883) is about half that amount.

Number of vessels belonging to the port, about 30, of 40 tons average.

The Port.—Half a mile to the southward of Wigton, is the small river Bladenoch, the port of Wigton.

Its estuary is almost dry at low-water, but probably vessels of 12 feet draught can enter it at high-water springs, and 6 feet at neaps. A steamer of 700 tons has entered it. There is a length of 600 feet quaysage.

The first bridge is $1\frac{1}{2}$ miles above the entrance, where is the village of Bladenoch. The river, in which salmon are plentiful, joins the sea by several channels through Wigton sands.

Above Wigton a flat marshy shore extends about 3 miles north-eastward to abreast Knockdown ferry.

LUCE BAY.—General remarks.—Luce bay, named from a small river which discharges at its head, extends far into Wigtonshire in a northerly direction ; it is contained between Burrow head and the Mull of Galloway, is 16 miles across between these points, and has a mean depth of 14 miles.

Luce bay is exposed to an indraught due to the prevailing southerly winds, and the becoming embayed is justly dreaded by sailing vessels passing in its vicinity or using the small ports around it. Southerly winds prevail in it for nine months in the year, and it is difficult at times for a small vessel to work out against the sea which is sent home.

The bay is free from dangers, except close in-shore, and the bottom is fine sand, except about the Scare islets or rocks, where it consists of gravel and rock. The soundings between the heads are from 20 fathoms at one mile off the Mull, to 12 and 14 fathoms abreast the Scares, and 15 to 17 fathoms the same distance from Burrow head. There is a general depth of 6 to 8 fathoms, sand and shells, in the centre of the bay.

In westerly winds, a vessel bound westward round the Mull may make use of East Tarbat bay, or lie-to under the land, while the flood stream is running.

Tides.—At the Mull of Galloway, the west point of Luce bay, it is high-water, full and change, at 11h. 15m. local time., 11h. 35m. Greenwich ; the approximate rise is 15 feet at springs, and 12 feet at neaps.

Race.—From the advanced position of the Mull and the consequent concentration of the tidal streams, aided perhaps by the character of the bottom near it, there are dangerous races and overfalls extending for 2 miles off, especially when the tidal streams are opposed by strong winds. During the flood the direction of the race is from the Mull towards Sinniness, near the head of Luce bay, and during the ebb it runs close in round the Mull to the north-westward ; a berth should be given to the Mull of at least 3 miles. The streams run at the rate of 6 knots at springs and 4 knots at neaps.

The tidal streams in Luce bay have a similar motion to the streams in Wigton bay. For instance, the flood stream begins, and

sets to the eastward round the Mull into Luce bay 2 hours before it is low-water upon the shore, or at entrance to Liverpool, and continues so until 4 hours flood; it then turns, runs westerly, and continues in that direction until 4 hours ebb, the general direction in the latter case being from Sinniness towards the Mull. The rate at springs is 4 knots, and at neaps 2 knots; in the north-west portion of the bay, however, the rate of both streams is gentle. At the Scares, the flood stream sets direct for Burrow head, and the ebb for the Mull of Galloway.

Scare rocks, situated in the middle of the entrance to Luce bay, are the only dangers beyond the distance of one-quarter of a mile from the shore.

Great Scare, 70 feet in height, bears from the Mull of Galloway lighthouse, E. $\frac{1}{4}$ S. $5\frac{1}{2}$ miles; and from Burrow head, W. by N. $\frac{1}{2}$ N. $10\frac{1}{4}$ miles. It is a bare rock without the slightest traces of vegetation upon it, and is bold all around at the distance of half a cable.

Little Scare consists of a small cluster of rocks N.E. two-thirds of a mile from the Great Scare, three of the heads being above high-water equinoctial springs. There are several detached rocks about them, but all within the distance of a cable from the highest rocks. There are depths of 8 to 9 fathoms between the Great and Little Scares.

EASTERN SHORE OF LUCE BAY.—From Burrow head a bold coast steep-to extends north-westward for 2 miles to the small inlets named ports Castle and Counan, where a high-water shingle beach begins, backed by the highlands of Glasserton, which have an elevation of 465 feet.

Lagg bay, southward of Lagg point, some 3 miles to the north-westward, may be used by coasting craft in off-shore winds. A stony ledge dries 2 cables off Lagg point at low water.

Monrieth bay lies between Lagg and Barsalloch points, and is one-third of a mile in depth, with high shores; it affords good shelter with the wind from between N.N.E. and S.E. A vessel may anchor in about 3 fathoms at low-water by keeping the coast under Carleton fell open of Lagg point, and the summit of Barhullion fell, 429 feet high, bearing E. by N. With the exception of some fine sand under the village of Monrieth, the low-water margin of the bay is stony; off Barsalloch point it dries about $1\frac{1}{2}$ cables.

PORT WILLIAM is the only place on the east side of Luce bay which affords any shelter with the wind from the southward; it has a good pier, which affords protection to about a dozen small

vessels from the prevailing south-westerly and southerly winds ; its head dries 6 feet at low-water springs.

Vessels of 12 feet draught can enter at high-water springs, and those of 8 feet at neaps. There is a warping buoy off the pier head.

At night, if a vessel is known to be off the port, a light will be shown from the pier-head.

Tides.—It is high water, full and change, at Port William, at 11h. 10m. local time ; equinoctial springs rise 22 feet, ordinary springs 18 feet, neaps 14 feet.

Anchorage.—Good anchorage will be found in off-shore winds, in 4 fathoms, one-third of a mile West from port William pier head.

Port William is a creek of Wigton, population in 1881 was 755 ; grain and other produce is shipped from here in coasting craft. About 80 small vessels visit the port, of the aggregate tonnage of 4,300 tons.

COAST.—From port William, the coast extends 5 miles north-westward to Garheugh craigs, off which it is foul to the distance of a quarter of a mile. Near the high-water line the coast is flat, backed at a short distance by a steep fall from the land within ; the low-water feature is about $1\frac{1}{2}$ cables in breadth ; the same feature continues to the Mull of Sinniness, a bluff head steep-to and 241 feet in height at 2 miles beyond.

In **Auchenmalg bay**, just eastward of Sinniness, anchorage may be taken with the wind off-shore, in 4 fathoms, one-third of a mile distant from the head of the bay.

Kinfillan bay.—From Sinniness the coast, bold and rocky, continues northward about $1\frac{1}{2}$ miles to the small bay of Kinfillan, where is anchorage with winds from north to south-east. The most conspicuous hilly feature is the Knock of Luce, elevated 503 feet, 3 miles within Sinniness ; also, about 3 miles to the southward, are the Doon of May, 447 feet, and Mochrum Fell, 636 feet in height.

LUCE WATER.—The coast from Kilfillan bay trends northward, forming the eastern side of the entrance to Luce water, the outlet being divided by an islet. The first bridge across the Luce, which is seldom reached by the tide, is one mile from the entrance, and the source of the water is in two principal streams from a northern direction about 15 miles in a direct course. The church of Glenluce is on an eminence one-third of a mile to the eastward of the bridge. At low-water springs, the Glenluce sands uncover to a distance of one mile from the entrance of Luce water, and on which small vessels lie in fine weather and discharge their cargoes.

Glenluce is a railway station distant 9 miles from Stránraer. The population is about 900. On the left bank of the river are the ruins of Glenluce abbey.

Piltanton Burn has a common outlet with the Luce at low-water, and sand-hills skirt the coast between the streams.

Small vessels discharge coal at the entrance to the burn near a ford, which may be safely crossed at low water. Dunragit hill, 2 miles inland, with a house and flag-staff 225 feet above high-water, is a conspicuous mark.

WESTERN SHORE.—MULL OF GALLOWAY, the south point of Scotland and the western boundary of the entrance to Luce bay, is a bold precipitous headland elevated 268 feet above high-water; and as regards depth may be approached with confidence, but the races off it cause overfalls of a dangerous character, especially with a weather-going tide. As the race extends 2 miles off, it would be prudent to preserve an offing of 3 miles. See description of race, page 428.

The Mull, which is a peninsula connected to the main by a low narrow isthmus, is one mile in length, by a quarter of a mile in breadth. On either side of the isthmus are the bays of east and west Tarbat.

LIGHT.—From a stone lighthouse, 86 feet in height, erected near the south-east extremity of the Mull, is exhibited, at an elevation of 325 feet above high-water, an *intermittent white* light, which is visible for *thirty seconds*, and eclipsed for *fifteen seconds*, between the bearings of S.E. $\frac{3}{4}$ E., through east, north, and west, to S.S.W.; and visible in clear weather from the distance of 25 miles.

Caution.—From the great altitude of this light it has sometimes happened that in hazy weather, with the clouds low, it becomes obscured, and vessels supposing themselves to be to the westward of it have run into Luce bay and become wrecked upon the sands at its head.

East Tarbat bay has the Mull of Galloway as a natural breakwater with the wind from the southward, and at such times is the most secure position within Luce bay. A storehouse and landing-place, for supplying the lighthouse, are situated at the head of the bay. The best anchorage will be found with the storehouse bearing West one-quarter of a mile, in $3\frac{1}{2}$ to 4 fathoms, with good shelter with the wind southward of S.S.E., and the tidal stream will scarcely be felt.

From East Tarbat bay the shore trends northward $1\frac{1}{4}$ mile to Maryport, and then north-east one mile to Killiness, which is low and

the first projection seen in Luce bay on rounding the Mull ; large stones dry at low-water rather more than a cable off the point.

DRUMMORE.—From Killiness the coast trends north-westward for one mile to Drummore quay, and is skirted with stones, dry at low-water to the distance of one cable ; off Drummore the foreshore is sand.

Drummore bay affords good anchorage with the wind from S.S.W., through west to North, in $2\frac{1}{2}$ fathoms, fine sand, with the pier bearing S.W., distant half a mile.

The quay, built under the shelter of a point below the village, will accommodate small coasters drawing 8 feet, towards high-water springs, but it is much encumbered by a bank of shingle scarcely covered at high-water, thrown up by southerly and south-easterly winds.

The trade consists of an import of coal and export of grain. Population in 1881 was 522. About 116 coasters visited the place in 1888, of the aggregate tonnage of 6,584 tons.

COAST.—From Drummore quay the general direction of the coast to Sandhead, west head of Luce bay, is north for 7 miles, and includes the following places :—

New England bay lies $2\frac{1}{2}$ miles from Drummore quay, Grenan craigs being the only clifly portion between. The bay, which is skirted by large stones near the low-water line, and enclosing a margin of sand, affords good anchorage with off-shore winds, in 4 to 5 fathoms.

Chapel Rossan bay, $1\frac{1}{2}$ miles northward from New England bay, affords good shelter from westerly winds, in $2\frac{1}{2}$ fathoms, sand, with the Mull lighthouse showing just over Drummore point. The south point is rocky and the north point stony, and there are also some patches of stones with 8 and 10 feet over them skirting the bay, so that anchorage should not be taken up within the above limit.

Sandhead bay.—From Chapel Rossan bay it is $1\frac{3}{4}$ miles to Ardwell mill, on the south point of Sandhead bay. There is also good anchorage in this bay, in $4\frac{1}{2}$ fathoms, with the mill bearing W. $\frac{1}{2}$ N., distant one mile.

The head of Luce bay, 6 miles across and contained between Sandhead and Kilfillan bays, has a high-water margin of sand-hills and a sandy foreshore, which dries on the average half a mile out at low-water. The depths towards this strand are regular, but it must be almost needless to say that a heavy sea breaks upon it shortly after a southerly wind has set in.

From Mull of Galloway north-westward, see Sailing Directions for West Coast of Scotland, Part II.

CHAPTER XIV.

ISLE OF MAN.

VARIATION IN 1891.

South-east side - $20^{\circ} 0' \text{ W.}$ | North-west side - $20^{\circ} 15' \text{ W.}$

GENERAL DESCRIPTION.*—The Isle of Man, situated in the northern portion of the Irish sea, is $26, 15\frac{1}{2}$, and $27\frac{1}{2}$ miles from the coasts of England, Scotland and Ireland, respectively. Its extreme length is 28 miles, in a north-east and opposite direction ; its greatest breadth is about 10 miles, the area being about 140,000 acres. Seen from a distance, the general aspect of the island is rather tame, for though the mountains which extend nearly through its entire length are of considerable altitude they do not tower up with sufficient abruptness to assume picturesque forms. The highest point of the range is Snaefell, or Snæfield, which is 2,034 feet high ; many of the other summits range from 1,500 to 1,800 feet in height.

The mountains and hills occupy a considerable portion of the surface of the island, and are chiefly composed of clay slate, containing some beds of roofing slate, varied by masses of granite. At the south end of the island, from Poyll Vaaish to Derby haven, mountain limestone rests upon the slate, but is separated from it by a bed of conglomerate. The middle of the island is occupied by a valley extending from Douglas to Peel, and a similar flat is to be found at the south end of the island between Derby haven and Bradda head. The north-east end is flat, and is generally composed of alluvial soil. There are mines of copper and lead, the latter producing a quantity of silver. The principal are those of Laxey on the eastern coast, and Foxdale, south of the road from Douglas to Peel ; the former are the most productive.

The island is well watered, numerous streams and rivulets issuing from the sides and bases of the hills. Some of the valleys are tolerably fertile in pasture, and where the ground is somewhat level grain is cultivated. There is little wood, but there is more in the northern district of the island than elsewhere.

It is probable that the island was originally peopled by roving Gaelic tribes, as their language and the Manx have but a slight dialectic

* See Admiralty chart of the Isle of Man, No. 2,094 ; scale, $m = 0.8 \text{ inch}$; also Nos. 45 and 1825a.

difference. In early times the sovereignty passed repeatedly between the Scots, the Welsh, and the Norse, the latter holding the longest dominion until it passed into the hands of Sir John Stanley in 1406; from that date until 1736 the island was held in feudal sovereignty by the Stanley family, afterwards Earls of Derby; in the latter year, failing issue, the possession fell to the Duke of Atholl, a descendant through a female branch. In 1765 the royalty of the island was sold to the Crown, and in 1829 all remaining interests were likewise disposed of, and the connexion of the Dukes of Atholl with the island terminated.

The Climate of the Isle of Man is mild and the temperature equable; the mean rainfall does not exceed 26 inches in the year, although the number of days on which rain falls is considerable, and in spring and autumn the island is visited occasionally with a continuance of cold east winds.

Trade.—The Isle of Man was formerly one of the principal seats of the herring fishery; it is still a considerable one, employing from three to four hundred boats. The principal exports are fish, agricultural produce, lead ore, some paper, linen, and sail cloth; and the imports spirits, wines, colonial produce, and manufactured goods.

It appears from the shipping returns that about 2,560 vessels, amounting to 416,000 tons, arrive at, and sail from the various ports, in the island during the year: while about 200 vessels of 12,500 tons belong to the island.

The population in 1881 amounted to 53,592.

The principal port is Douglas, on the east side of the island (p. 444), which has depths of 3 fathoms at low water in the outer harbour, and a tidal harbour within.

The seat of Government is at Castletown, p. 439.

A description will first be given of the eastern side of the island from the Calf of Man to the northward, and then of the western side from the point of Ayre to the southward.

CALF OF MAN, situated off the south-western extremity of the island, and separated by Calf sound, is irregular in outline, about one mile in length and breadth, and with an area of about 600 acres; the summit of the Calf is 360 feet high. It is partly cultivated, has one farm-house upon it, and two landing-places, named North or Grant and South havens, connected by road with the farm and disused light-houses.

A Lloyd's signal station is established at the Calf of Man,

Two stone light-towers stand close to the cliff at the western point of the island but the lights have been discontinued since the erection of the lighthouse on Chicken rock.

From North haven, where the shore is low and rocky, the coast trends north-westward for one-third of a mile to Jubdale creek, an open and exposed bight one cable in depth; thence the coast, consisting of precipitous cliffs varying from 100 to 350 feet in height, trends westward to the Stack.

The Stack, a rocky islet off the disused low lighthouse, is 107 feet in height; in the boat passage separating it from the Calf is a sunken rock, and another rock, dry at low-water, lies 50 yards from its north end.

Southward from the old low lighthouse, the coast cliff for two-thirds of a mile declines in height to Caigher point, between which and Burrow cliff eastward of it, is an irregular indentation which is occupied for the distance of a cable from the shore by rocks which uncover at the last-quarter ebb. Nearly midway, also, between the old low light-house and Caigher point, are two rocks about one cable from the shore, with two fathoms over them at low-water.

Burrow cliff, bold and rocky, 120 feet high, and appearing like an island from being connected to the Calf by an isthmus which covers at high-water, is sometimes called the Eye, from its being completely perforated. Three rocks, covered at high-water, named the Clets of the Burrow, lie half a cable from the cliff in a south-east direction. In the cove westward of Burrow cliff, $1\frac{1}{2}$ cables deep and half a cable broad, with 3 to 10 fathoms at low-water, fishing vessels obtain shelter from northerly winds.

Thick head, north-eastward nearly one mile from the Burrow is 250 feet in height, but the cliff declines from thence towards North haven. At $2\frac{1}{2}$ cables north-eastward of Thick head, are six rocks, the Clets of the Sound, which dry at first-quarter ebb.

CHICKEN ROCK, about 6 cables south-westward of the Calf, is 5 or 6 feet above high-water springs; a patch of 4 fathoms, with deep water close-to, lies about one cable south-eastward of it; depths of 18 to 24 fathoms will be found about midway in the channel separating it from the Calf.

LIGHT.—A lighthouse, built of light-coloured granite, and 143 feet high, stands on Chicken rock, from which is exhibited at an elevation of 122 feet above high-water, a *revolving white* light, which attains its greatest brilliancy *every half-minute*, and visible in clear weather from a distance of 16 miles.

Fog Signals.—In thick or foggy weather an explosive fog signal, which gives a report like the discharge of a gun, is fired at intervals of *ten minutes*, from a gaff surmounting the lantern. A bell is also sounded at intervals of *half a minute*.

Wart bank, about half a mile in extent, east and west, with depths of 7 to 10 fathoms, and deep water around it, lies $1\frac{1}{2}$ miles south-eastward of the Calf, with Chicken rock lighthouse bearing W.N.W.; an isolated patch of 10 fathoms lies about 3 cables north-west of its west extreme.

CALF SOUND* is reduced to a breadth of about 150 yards, by the small island of Kitterland and its surrounding ledges, as well as by Thousla rock projecting from the Calf near North or Grants haven. Upon Thousla rock, which dries at first-quarter ebb, is an iron beacon, surmounted by a barrel-shaped cage, painted red, and elevated 25 feet above high-water springs.

The southern entrance of the Sound is bounded by the precipitous cliffs of Thick and Spanish heads, with depths of 10 to 12 fathoms between. Spanish head received its name from the fact that several of the ships of the Spanish Armada were dashed to pieces upon it. Kitterland island is covered with grass, and Thousla rock is well marked by its beacon.

Directions.—The general course through the Sound is N. by E. in depths of 9 fathoms, but the navigable channel is not more than half a cable wide at low water, as a rock, with a depth of 6 feet, lies 70 yards from the west side of Kitterland; the tidal streams run with considerable strength, and the Sound should be only taken by those acquainted with it.

Tides.—It is high-water, full and change, at the Calf at 11h. 17m. local, 11h. 37m. Greenwich time. Equinoctial springs rise $20\frac{3}{4}$ feet, ordinary springs $16\frac{1}{2}$ feet, and neaps $12\frac{3}{4}$ feet.

From Spanish head, the ebb tide sets north-westward directly towards Thick head, and from thence over the Clets of the Sound; the flood, on the contrary, passes from between Thousla rock and Kitterland island over the outer Clet, and is from thence deflected towards Spanish head. The general rate of the streams in the Sound is $3\frac{1}{2}$ to 4 knots on springs, and 2 knots on neaps.

The flood stream runs southward through the Sound, from about $2\frac{1}{2}$ hours before low water, until 2 hours before high water by the shore, the ebb stream the reverse.

* See plan of Calf sound, on Admiralty chart No. 2094.

The stream past Chicken rock runs at the rate of $4\frac{1}{2}$ knots at springs, and $2\frac{1}{2}$ knots at neaps ; but within the rock, along the Calf shore from the Stack to Burrow cliff, there is but little stream.

About 5 miles south-west of the Calf, the flood and ebb streams set S.E. by E. and N.W. by N. at the rate of half a knot ; north-west of this position there is scarcely any perceptible tide. *See* pages 17, 18.

POYLL VAAISH BAY lies between Kallow point near port St. Mary, and Scarlet point, and is about $2\frac{1}{4}$ miles wide, with depths of 4 to 10 fathoms ; it is directly open to the southward, and has but indifferent holding-ground, from the presence of numerous patches of rock and coral over its whole extent. The low and uneven shores are skirted for a breadth of about 2 cables on the average, by rocks, ledges, and large stones, with the exception of a sandy bight in the north-west corner.

Carrick rock occupies the centre of the bay ; it is 500 yards long, 160 yards wide, and dries 14 feet at low-water springs. About one cable off its eastern end, is a sunken rock with a depth of 4 feet.

Langness lighthouse, well open of Scarlet point Stack, leads southward of the Carrick. At night, the *red* light on the hill upon the west side of port St. Mary kept in line with the *white* light on the pier-head also leads southward of the Carrick.

Anchorage.—Vessels, while waiting tide to enter port St. Mary in off-shore winds, may anchor between the port and Carrick rock, in 3 to 4 fathoms. The holding-ground, however, is not good, and a heavy sea is sent in with winds between south-west and south-east. It is frequented in the summer season by smacks of 70 to 90 tons burden, and by the herring vessels.

PORT ST. MARY.*—The small tidal harbour of St. Mary, in the north-west corner of Poyll Vaaish bay, has been much improved by the construction of the Alfred pier, 1000 feet in length, on St. Mary's point, at about 300 yards seaward of the harbour pier, which pier affords considerable shelter to the fishing fleet at all times of tide. The harbour is quayed all round, and the passage in between the pier-head and the ledges from the shore, is about 200 feet wide. The area is rather more than 2 acres, over a bottom of mud and clay, and there is a crane equal to lifting about 2 tons.

Vessels of 12 or 13 feet draught can enter the port at high-water spring tides, and those of 8 or 9 feet at neaps ; it shallows gradually towards the head.

* *See* plan of port St. Mary (scale $m=6\cdot75$ inches) on Admiralty chart No. 2094.

LIGHTS.—From a white octagonal lighthouse on the outer end of port St. Mary inner pier, a *fixed white* light is shown all night at a height of 25 feet above high water, visible at the distance of 9 miles in clear weather.

A *fixed red* light is placed at 36 feet above high water on the hill upon the west side of the port ; this light kept in line with the pier light leads southward of Carrick rock.

A *fixed green* light is exhibited from a white lighthouse, 25 feet above high water, at the outer extreme of the Alfred pier or break-water.

Directions.—When Carrick rock is covered, there is a depth of 7 feet at the entrance to port St. Mary. In entering, give Kallow point and Alfred pier a berth of 2 cables until northward of the lights in line, when steer for the entrance, and round into the inner harbour as close to the lighthouse as circumstances will permit.

When not employed in agriculture, the inhabitants of port St. Mary spend most of their time in fishing for cod, herring, and lobsters.

Port St. Mary is a creek of Castletown.

Tides.—It is high water, full and change, at port St. Mary, at 11h. 10m. local time, 11h. 30m. Greenwich ; equinoctial springs rise 24 feet, ordinary springs 22 feet, neaps 18 feet. There is very little stream of tide in any part of the bay.

CASTLETOWN BAY, contained between Scarlet point Stack and Langness, is $1\frac{1}{2}$ mile wide, and rather more than one mile deep.* The depth at the entrance varies from 5 to 13 fathoms, over a rocky and uneven bottom ; and, with the exception of the south-eastern portion, the whole bay is occupied by rocky foreshores, and sunken ledges.

Lheeahrio rock, the outermost of the detached masses upon the north-west side of the bay, is 2 cables in length, of irregular form, and with many fangs ; it dries 16 feet at low water springs.

Buoy.—A black buoy in 3 fathoms is placed nearly one cable south-eastward of the rock, with castle Rushen bearing N. $\frac{1}{2}$ W., and the Stack W. by N.

Anchorage.—The bay, from being directly open to the south-westward, from its foul bottom, and the confused tidal streams in its neighbourhood, is not recommended. The anchorage usually taken, is in 7 to 10 fathoms, over a patch of gravel and sand, $1\frac{1}{2}$ cable south-eastward of the buoy, with Spanish head just open of

* See plan of Castletown bay (scale $m=3\cdot9$ inches) on Admiralty chart No. 2094.

the Stack, and Rushen castle N. by W. In working in to this anchorage, do not shut Spanish head in behind the Stack until eastward of the buoy, or until the lighthouse upon Castletown pierhead bears westward of North.

CASTLETOWN HARBOUR is available for vessels of 12 feet draught at high water springs and 8 feet at neaps; there is one foot less water in the basin. The harbour was originally formed between a pier 100 yards long, in a southerly direction, and a tongue of ledges covered at high-water, eastward of it; the entrance between them being 100 feet wide.

In 1849, a new pier outside the old one, in the form of a segment of a circle, and 420 feet long, was completed, including between it and the old pier a space of $1\frac{1}{4}$ acres, the distance between the pier-heads being 222 feet.

Two swing bridges divide the old harbour into three portions; the one above the lower bridge is $1\frac{3}{4}$ acres, in area, the width between the abutments of the bridges being 26 feet; it is quayed all round, and has a bottom of gravel.

LIGHT.—From a lighthouse of gray stone near the head of the new pier is exhibited, at an elevation of 22 feet above high water, a *fixed red* light, shown all night, and is visible between the Stack and Langness, in clear weather, for a distance of 8 miles.

Tides.—It is high water, full and change, at Castletown, at 11h. 10m. local time, and 11h. 30m. Greenwich time; springs rise 20 feet, neaps 16 feet. A strong tidal stream beginning with the ebb by the shore, sets across the bay in an easterly direction at the rate of $2\frac{1}{2}$ knots, forming an eddy farther in.

The streams run close past Langness at the rate of 5 knots at springs and $2\frac{1}{2}$ knots at neaps; the southern stream runs 10 hours, from 2 hours flood to the last of the ebb. Five miles off shore the flood and ebb set about east and west, at the rate of two knots, turning nearly with Liverpool.

Directions.—Pilots.—Fishermen act as pilots, their charge varying from 5s. to 20s., according to tonnage.

Closing the harbour from a position one cable eastward of the buoy in Castletown bay, steer for the lighthouse on the pier-head bearing N. by W. $\frac{1}{2}$ W.

Lifeboat.—A lifeboat is maintained here, together with a rocket apparatus, belts, and lines.

Castletown, though the capital of the island and the seat of Government, is, neither in size nor importance, to be compared to

Douglas. The principal building, Castle Rushen, built by the Danes in 947, is kept in thorough repair, and is the only fortress upon the island. It is quadrangular, and flanked with towers on each side, the northern or flag-tower rising to the height of 80 feet, the whole being surrounded by an embattled wall and fosse, and by a glacis of stone; in the castle is a court-room and other government offices. The octagonal tower of St. Mary's chapel is also a prominent object. About two-thirds of a mile east of the castle is King William's college, standing a little within the shore at the head of the bay, and the most conspicuous object upon the southern side of the island. It was founded in 1830 for the education of young men to supply the Manx churches; the building, in the Elizabethan style, is a spacious cruciform structure, with an embattled tower, 115 feet high, rising from the intersection.

Supplies, Trade, &c.—Small repairs can be made to coasting craft, and water may be filled from a pipe at the quay side. The exports are agricultural produce and lime, and the imports coal and general goods.

The population in 1881 was 2,243.

LANGNESS, the termination of the peninsula which separates Castletown bay from Derby haven, is distinguished by a lighthouse, and also by a land-mark standing one-third of a mile from its outer end, which was built previous to the erection of the lighthouse to prevent Langness being mistaken for Scarlet point. The mark is a stone tower 43 feet high, with its base 62 feet above high-water.

A singular chain of insulated rocks, 10 feet above high-water, under the general name of Langness point, extends 3 cables to the westward from the Ness, having near its outer end the Skerranes, eight rocks which dry at half ebb. From Langness to St. Michael's island, Derby haven, the coast trends north-eastward for $1\frac{1}{2}$ mile, and consists of rugged abrupt rocks of slate formation.

LIGHT.—A circular light-tower, built of dark gray stone, and 63 feet in height, stands on the south-east part of Langness, from which is exhibited, at an elevation of 76 feet above high-water, a *flashing white* light, showing a flash *every five seconds*, visible in clear weather from a distance of 14 miles, except where obscured by the coast.

Fog signal.—In thick or foggy weather, the fog siren on Langness, at 30 feet above the sea, is sounded at regular intervals, the periods of sound being of *five seconds* duration, and the periods of silence of *forty seconds* duration.

Directions.—In approaching from the westward, to guard against the indraught, on the ebb, between Chicken rock and Langness, sailing vessels should maintain an offing of three or four miles.

In gales, a highly dangerous sea is often formed over some rough ground with 7 to 9 fathoms, situated south eastward three-quarters of a mile from St. Michael's island ; to avoid it, keep Clay head well open of Douglas head.

DERBY BAY AND HAVEN.*—Derby bay contained between St. Michael's island and St. Ann's head, is $2\frac{1}{2}$ miles wide by two-thirds of a mile deep. The shore from St. Michael's island to Ronaldsway is flat, and from thence to Kirk Santon head, which is elevated 253 feet, are cliffs varying from 20 to 200 feet in height.

Anchorage.—The only portion used for anchorage is the entrance to Derby haven, upon the west side of the bay, under the cover of St. Michael's island ; but this is open to the eastward, and in gales from north-east to south-east the sea sent home renders it a dangerous place to be caught in.

The usual berth is in 3 to 4 fathoms, with the ruined fort on St. Michael's island bearing S. by E. $\frac{1}{2}$ E., and the south-west end of the breakwater, W. by N., and rather nearer to the island than to the north side of the bay. The holding-ground is good, being sand over marl. In closing the anchorage it is necessary to give St. Michael's island a berth of one cable, in order to avoid the ledges which project from it.

St. Michael's, or, as it is generally called, Fort island, from the ruined fort near its north-eastern end, built by James, the seventh Earl of Derby, forms the east side of the Haven. Upon the inner end of the island, which is connected to the shore by a causeway, are the scanty ruins of the ancient church of St. Michael.

Tidal harbour.—The haven is about half a mile wide, and the same distance in depth, but fully half that extent is dry at low-water. A portion of it has been converted into a tidal harbour, by the erection of a breakwater upon one of the ledges extending south-westerly from Ronaldsway kiln on the north point of entrance, covering in the frontage of Derby haven village. This work, having a north-east and south-west direction, is 260 yards long and 26 feet wide at the top, and the ledge on which it stands dries 13 feet at low-water ; it affords protection to a space of about 4 acres, and is furnished with mooring posts throughout, and with a landing-slip 100 feet from its north-east end.

* See plan of Castletown bay and Derby haven, on Admiralty chart No. 2094.

Directions.—Depths.—The south-western entrance, the one generally used, is between the end of the breakwater and a pole or perch upon the north-east end of a rocky ledge, the distance between them being about 60 yards. At high-water springs there is a depth of 15 feet in this passage, and at neaps 11 feet, with from 3 to 4 feet less water inside. The bottom is a mixture of mud, sand, gravel, and marl ; but for some distance within the breakwater the space is occupied by the ledge on which it is based, and is consequently unfit for berthage.

The north-east entrance, 60 yards wide, and with 9 feet in it at high-water springs, is seldom used.

Light.—A *fixed white* light is shown from a tower at the south-west end of the breakwater, at the height of 14 feet above high-water, and is visible at the distance of about 2 miles.

COAST.—Baltic rock, uncovering at half-ebb, lies South, half a cable from St. Ann's head, and a little outside of it is a rock with 3 feet at low-water. From St. Ann's head to Douglas head the whole coast is composed of cliffs varying from 100 to 400 feet in height. Port Soderick, a small bight with a landing-place one mile to the westward of Littleness, has a white house a short distance within its beach ; some rocks, covered at high-water, extend two-thirds of a cable off Littleness ; from thence to Douglas head the cliffs are irregular in height and bold-to.

DOUGLAS HEAD is a bold feature when seen from northward or southward ; on its summit, 234 feet above the sea, is the Head hotel, a large building with a tower. The head is fringed by a low-water ledge to the distance of half a cable, with deep water close-to.

LIGHT.—From a white stone lighthouse, 65 feet high, erected near the extreme of Douglas head, is exhibited, at an elevation of 104 feet above high-water, a *fixed white* light, visible in clear weather from a distance of 14 miles. It is obscured inshore of the bearing N.E. $\frac{1}{4}$ E., and will, consequently, not be seen within 3 miles of Langness point.

DOUGLAS BAY, situated near the centre of the south-eastern side of the island, is contained between Douglas head and Banks Howe, $2\frac{1}{2}$ miles apart, with depths of 10 to 11 fathoms between.*

Aspect.—The coast consists of precipitous cliffs extending inwards from Douglas head, backed by the slopes of Nunnery Howe, the summit

* See Admiralty chart of Douglas bay, No. 2696 ; scale, $m = 12$ inches : also plan of Douglas harbour, on chart No. 2094 ; scale, $m = 12$ inches.

of which is 480 feet high. The town of Douglas, with its outskirts, extends for $2\frac{1}{2}$ miles along the shore, and is succeeded by a bold coast line, Banks Howe sloping down from an elevation of 393 feet.

The foreshore of gravel, sand, and rock extends from the head of the bay for about 2 cables, with rocky under-water ledges projecting the same distance beyond.

The town of Douglas has an imposing panoramic effect in the approach from the offing, skirting along the rising ground for nearly the whole extent of the bay. About midway, and just within the shore of the bay, is the extensive and handsome erection of Castle Mona, formerly the residence of the Duke of Atholl, but now converted into an hotel; behind it the slopes are studded with villas. The chief portion of the town is along the north-east side of the harbour, and the towers and spires of its various churches are the most prominent of its public buildings.

Piers.—Half a mile to the northward of the harbour an iron promenade pier extends 1,000 feet from the shore in a south-east direction; its extreme is barely dry at low-water equinoctial tides. *See Light, p. 445.*

There is an iron pier, about 120 yards in length, extending southward from the west point of entrance to port-e-Vada, in the north-east part of the bay; its extreme dries about 8 feet.

Conister or St. Mary's rock, a detached ledge of rock situated one cable north-eastward of the harbour, and upon which numerous vessels have been wrecked, is $1\frac{1}{2}$ cable in extent in an east and west direction, by one cable across. Upon the summit of the rock, which is covered at high-water, is a castellated beacon or refuge tower (built in 1833), with flagstaff, to afford a safe retreat for the crews of vessels wrecked here.

Foul ground, with rocky heads of 14 to 16 feet, extends 3 cables seaward of the refuge beacon; the outer patch with 16 feet water, and 5 to 6 fathoms just beyond it, lies with Douglas head lighthouse bearing S.W. $\frac{1}{4}$ W., and the refuge beacon N.W. by W. $\frac{1}{2}$ W. A rocky ledge with less than 6 feet water, extends about 2 cables seaward of the promenade pier.

Anchorage.—Douglas bay is open to the south-eastward, and the holding-ground in most parts of it is indifferent; a good temporary position is about one cable north-eastward of the breakwater, in depths of 6 to 7 fathoms, sand and small stones, over clay, the same character of bottom continuing to the mouth of the harbour, with gradually decreasing depths. Vessels must, however, not obstruct

the fairway of the approach, and as the harbour affords ample accommodation for such vessels that are likely to call here, it should be taken advantage of.

Landing.—Within the Conister rock is a landing-slip extending from the Pollock rock, on which the Victoria pier is built ; the slip is available for boats at all states of the tide.

DOUGLAS HARBOUR.—The outer harbour is nearly 2 cables in extent, with a depth of 4 fathoms at low-water at its entrance, 3 fathoms near its centre, 12 feet alongside the breakwater, and 10 to 15 feet alongside the outer end of Victoria pier. It is formed by the Victoria pier which extends nearly 450 yards south-eastward of Percival hotel, (and nearly parallel to the Red pier, distant about 160 yards) and the curved breakwater, about 300 yards in length, which extends in a general east-north-east direction from Little head, having an entrance about 200 yards wide. The extension of Victoria pier (in progress) will reduce this width, and render the harbour more secure.

The pier and breakwater are fitted with mooring bollards for the use of the mail steamers and others.

The inner or tidal harbour is dry at low-water springs, but has a depth of 18 feet at high-water springs in the entrance. Vessels of about 13 feet draught can usually enter at high-water springs, and those of 9 feet at neaps. The great drawback to both harbours is the heavy sea thrown in during south-east gales, and which is felt as far up as the bridge. These winds cause sometimes a bar 2 or 3 feet in height to form abreast the inner pier-head, but this is as constantly removed.

The inner or tidal harbour is formed by the outlet of Douglas river, which consists of two main branches, uniting about one mile above the town, the one rising on the west side of mount Gurraghan, named the Dhoo, and the other the Glass, from amidst the Greba range ; the first with a very irregular course towards the south-west and south-south-east, and the latter for nearly the whole distance preserving a south-east direction to the harbour.

The entrance to the inner or tidal harbour is covered by the Old or Red pier, which extends 200 yards in a south-east direction from the north point of the river, terminating in a circular and raised head, in the centre of which is the harbour lighthouse : a transverse pier for checking the in-run of the sea, extends out 90 yards from the south bank from below Fort Anne hotel, leaving an entrance between of about 75 yards in width, dry at low water springs.

The harbour is quayed up to the bridge, a distance of nearly half a mile; the space included is equal to about 11 acres, the bottom consisting principally of gravel over marl.

LIGHTS.—From a concrete tower at the outer end of the breakwater is exhibited a *fixed red* light, at an elevation of 40 feet above high-water, visible in clear weather a distance of 6 miles.

From a lamp post on the outer end of Victoria pier, is exhibited at an elevation of 25 feet above high-water, a *fixed green* light visible 3 miles.

A *fixed blue* light is exhibited from the outer end of the iron promenade pier northward of the harbour; it is 20 feet above high-water, and should be visible in clear weather at the distance of 2 miles.

Tidal Light and Signal.—From a light-tower on the head of the Red pier, a *fixed white* light is shown, 38 feet above high-water, while there is a depth of 9 feet on the bar at the pier-head. By day a red ball indicates the same depth. The light is visible at the distance of 6 miles.

Tides.—It is high-water, full and change, in Douglas bay, at 11h. 12m. local, 11h. 30m. Greenwich time; equinoctial springs rise 24 feet, ordinary springs rise $20\frac{3}{4}$ feet, and neaps 16 feet.

About half a mile eastward of Douglas head the flood stream sets to the north-eastward and the ebb to the south-westward at the rate of 2 knots per hour during springs.

The in-shore portion of the flood stream sets into Douglas bay towards Onchan bight at the rate of $1\frac{1}{2}$ mile per hour. The ebb stream at Banks Howe, eastward of Onchan bight, begins one hour before high-water by the shore; towards the centre of the bay it divides, one portion setting inside and the other outside of Conister rock, at the rate of about one knot. Southward of the rock they unite, sweep round Douglas head, and join the main stream half a mile outside of it. The stream from the inner portion of the bay, from about the promenade pier, sets southward towards the pier and out past Douglas head for 9 hours out of the 12, beginning at half flood.

Pilots.—There are no licensed pilots.

Directions.—Approaching from the northward, by keeping the breakwater lighthouse westward of a W. by S. bearing, the foul ground eastward of Conister rock will be avoided. From the southward pass Douglas head at a prudent distance, and round into the harbour. A sailing vessel should borrow as closely to the Douglas head ledges as practicable when it is blowing fresh from the westward, so as to fetch into the anchorage, and to avoid the risk of being driven to leeward of the Conister rock by the strong and

variable gusts from the high land. Outside the Conister a vessel would be exposed and in a bad anchorage.

Lifeboats.—There are two lifeboats stationed at Douglas, and also a rocket apparatus.

DOUGLAS, although not the capital, is the largest and most important town in the island. It has numerous fine hotels for the accommodation of their summer visitors. In 1881 the population amounted to 15,719. Promenade pier, *see* p. 443.

Communication.—There is a railway from Douglas to Castle-town, port Erin, Peel, and Ramsey. Direct steam communication is maintained with Liverpool, distant about 68 miles, daily throughout the year, and to Barrow daily during the summer; also to Dublin, Whitehaven, Silloth, and Glasgow once a week.

There is telegraphic communication, by means of submarine cable (between port Cornah, 8 miles north-eastward of Douglas, and St. Bees, entrance to Firth of Solway) with all parts of Great Britain.

There is a marine barometer near the harbour office, for the benefit of seamen and fishermen. Danish and Swedish consuls are resident.

Supplies, Trade, &c.—Douglas offers no special facilities for repairs, but has an iron foundry. Supplies of coal are generally obtainable, and other requisites for shipping can be procured. Water is led down by pipes to the pier-heads. The numerous visitors conveyed by the various steamers to the island during the summer is one of the most striking characteristics of the place.

LAXEY BAY is contained between Clay and Laxey heads, distant $2\frac{1}{4}$ miles from each other, and affords anchorage in convenient depths, with off shore winds, in depths of 5 to 7 fathoms, fine sand. Kirk Lonan, with a pinnacled tower, is prominent on the outline, and the village of Laxey, with a steep beach fronting it, is clustered about the cultivated slopes and the mouth of the Vale of Laxey river, which river descends from the eastern declivity of Snaefell.

Harbour.—A small harbour is being formed at Laxey, by the construction of a jetty on the outer extreme of the ledge extending from the shore northward of the old pier. This jetty lies at right angles to the old pier, is 128 feet in length, with a width of entrance to the harbour of 200 feet. The harbour dries at low water, but there is a depth of 16 feet alongside the jetty at high-water ordinary springs.

Light.—A temporary light is exhibited from the head of the old pier, visible southward between the bearing of N.N.W. and the land. Its eastern limit leads about 50 feet south-westward of the works in construction.

Coasters load here with the lead ore obtained from the mines in the neighbourhood.

COAST.—The coast between Laxey head and Maughold head, about $4\frac{1}{2}$ miles north-eastward of it, consists of cliffs ranging from 100 to 200 feet in height, and is similar to that to the south-westward of Laxey bay. At half-a-mile north-eastward of Laxey head is Carrick Roayrt, a small rock which dries at first quarter ebb, at one cable from the shore, with deep water close to. At 2 miles north-eastward of Laxey head is the Kenny river, fronted by a steep beach; port Cornah, the creek within it, can be entered by boats after half-flood. Cultivation extends over the vale of the Kenny, as well as over a portion of the neighbouring hills.

Submarine cable.—From port Cornah, a telegraph cable is laid to St. Bees' (p. 392), entrance to Firth of Solway, as stated on p. 447.

Maughold head, a cliff 373 feet high and the most eastern point of the island, is rendered more conspicuous from having a hill summit just within; it is bold close to. A little within the head is the ancient parish church and surrounding houses of Maughold, and on the cliff side, a well, famed for its supposed medicinal properties.

Half a mile south-west of the head is port Moar, with a beach at its head, and comparatively low land about it, but the shores of the bight are fronted by low water ledges, with depths of about 3 feet between.

RAMSEY BAY,† situated north-westward of Maughold head, affords sheltered anchorage from winds between S.W. and N.N.W., in from 4 to 7 fathoms, over a gradually shelving bottom of sand, but it is exposed to easterly winds. A heavy sea is thrown in when the wind is strong between E.N.E. and S.S.E.

The Carrick.—Beacon.—The bay is free from danger, with the exception of the Carrick, a rock marked by a red beacon, with skeleton globe 10 feet above high water, and situated 2 cables off shore at 8 cables southward of the harbour.

Aspect.—From Maughold head to as far as the town of Ramsey, the shore is backed by high and moderately wooded hills, upon one of which, south of the town, and elevated 390 feet, the Albert tower, built to commemorate the visit of the late Prince Consort, is very prominent. North Barrule, a peak 1840 feet in height, the north-east extreme of the main ridge from Snaefell, lies 2 miles south-west from Ramsey, and northward of Sulby river, which passes through

* See chart of the Isle of Man, No. 2,094.

† See plan of Ramsey bay, scale $m = 6.7$ inches, on chart of the Isle of Man, No. 2,094.

the town; the land is low and well cultivated, especially around Kirk Andreas. Close northward of the town of Ramsey is a conspicuous windmill.

Three miles north-eastward is Cranstal point, with Break-o-day hill 267 feet in height close over it. This hill is the south-east corner of a triangular range $1\frac{1}{2}$ mile in length, the eastern face of which forms the shore cliff, fronted by foul ground to the distance of $1\frac{1}{2}$ cables. Northward of this ridge, to Ayre point, and southward of it to the town of Ramsey, the coast is low, and skirted by a shingle and sandy beach.

Landing pier and lights.—An iron landing and promenade pier, named the Queen's pier, 750 yards in length, with a depth of 14 feet at low water springs at its extreme, is situated about 3 cables southward of the entrance to the harbour. *See* lights, below.

Tides.—It is high-water, full and change, in Ramsey bay, at 11h. 12m. local, 11h. 30m. Greenwich time; springs rise $20\frac{3}{4}$ feet, neaps 16 feet. The stream in the bay runs 9 hours to the northward and 3 hours to the southward, the latter beginning at 2 hours flood; but off Maughold head the stream sets 9 hours to the southward, turning to the northward one hour before low-water, and so continuing until 2 hours flood.

RAMSEY HARBOUR is tidal and formed by the outlet of the Sulby, the largest river in the island, and which rises in Snaefell; it is protected at the entrance by two parallel piers extending seaward for about 300 yards; the sand and shingle foreshore dries out about 100 yards beyond them.

The entrance is 50 yards wide, with a depth of 17 feet at high-water springs and 12 feet at high water neaps; the two piers have a depth alongside of about 15 to 16 feet at high-water springs, and there is about the same depth in the eastern part of the harbour; the western part has from 3 to 6 feet less water.

At the heel of the south pier the harbour turns sharply to the southward and then makes a complete horse-shoe bend along the quays which skirt the town. The soil is gravel over clay. Freshes are sometimes heavy, and the tide flows about two miles up the river.

LIGHTS.—From a lighthouse at the end of the north pier of Ramsey harbour, a *fixed green* light is exhibited at an elevation of 34 feet above high-water, visible in clear weather from a distance of 9 miles; and from a lighthouse on the south pier-head is exhibited a *fixed red* light, 28 feet above high-water, and visible 4 miles off.

The extremity of the promenade pier is marked by two *fixed red* lights placed vertically at 25 and 35 feet above high water.

Directions.—Vessels of 16 feet draught may reach the quay at high-water springs, and those of 9 feet at neaps. Pilots are to be obtained in moderate weather, but there is no difficulty in entering. When steering in between the piers, guard against the set across the entrance during on-shore winds. In case of extremity, beach as near the harbour entrance as possible, should there not be sufficient depth of water to run into the harbour.

Lifeboat.—A lifeboat and a rocket apparatus is kept in readiness just southward of the south pier to assist stranded vessels.

Town.—The town of Ramsey is situated on the south side of the harbour, and affords accommodation for summer visitors. A promenade pier (before mentioned) extends seaward from the south end of the town. The population in 1881 was 4,025.

Supplies of provisions and coal are obtainable in moderate quantities, and water is led down in pipes to the quay. The exports consist of lead, grain, and cattle, and the imports of coal, building materials, and general goods.

Communication with Liverpool and Whitehaven is maintained once a week by steamer, the distances being 76 and 30 miles respectively. During the summer months there is pretty constant communication by passenger steamers with Liverpool, and daily *via* Douglas. There is telegraph communication with England by submarine cable from port Cornah, p. 447.

AYRE POINT,* the north-eastern extremity of the Isle of Man, is the termination of a plain $6\frac{1}{2}$ miles in length, extending northward from the Sulby river. From the point, the coast, all the way to Ramsey, and also nearly to Peel, on the opposite side of the island, is fronted by a low, sand and shingle beach, to the distance of one cable.

LIGHTS.—From a white lighthouse, painted with two horizontal red bands, 99 feet in height, erected one-quarter of a mile within Ayre point, is exhibited, at an elevation of 106 feet above high-water, an *alternating* light *every minute*, showing *white* and *red* alternately; it is visible at the distance of 16 miles in clear weather from between the bearings N. $\frac{3}{4}$ E., through west and south, to E. $\frac{1}{2}$ S., within which bearings the light is obscured by the land.

A *fixed white* light, of low power, is exhibited from a tower erected on the extreme of the point, at an elevation of 25 feet above high

* Commonly known as the Point of Ayre.

water, visible between about the same bearings as the main light ; it may possibly be seen 10 miles in clear weather.

Fog Signal is a siren, erected near the low light, which gives *three blasts* (high, high, low), of $2\frac{1}{2}$ seconds each, in quick succession, *every three minutes*.

BANKS off Ayre point.—**Strunakill bank** is half a mile in extent, with a least depth of $4\frac{1}{4}$ fathoms, from which Ayre point lighthouse bears S.S.E. $\frac{1}{2}$ E., distant one mile. The tidal streams set directly across this bank, and when they are opposed by strong winds a heavy sea is formed over it ; the channel between the bank and the shore has depths of 10 fathoms and is half a mile wide.

Whitestone bank, situated eastward of Ayre point, is composed of white stones and gravel, and has a least depth of 8 feet, with the lighthouse bearing N.W. $\frac{3}{4}$ W., distant $1\frac{1}{4}$ miles. From this shallow spot, the bank within the 5 fathom line, extends one mile southward, with patches of $3\frac{1}{2}$ fathoms in places. To the northward it is connected with Ayre point by Ayre hook, which has depths of 4 to $4\frac{1}{2}$ fathoms.

The sea breaks heavily over Whitestone bank during strong winds.

Clearing mark.—Ramsey old windmill, just open of the clay cliffs, bearing S.W. $\frac{1}{2}$ S., leads over Ayre hook, and westward of Whitestone bank, in 4 fathoms.

BAHAMA BANK lies near the edge of the 10-fathom line fronting the coast southward of Ayre point ; its north-west extreme being half-a-mile eastward of the south extreme of the Whitestone bank.

Within a depth of 5 fathoms, it is 5 miles in length, by half-a-mile in breadth ; its least depth, rather southward of the centre, is 5 feet, from which Ayre point light bears N.W. $\frac{1}{2}$ N., distant $5\frac{1}{4}$ miles, and Maughold head extreme S.W. $\frac{1}{2}$ W. Depths of 9 to 18 feet will be found extending over the distance of half-a-mile southward of this position, and also $2\frac{1}{2}$ miles N.N.W. $\frac{1}{2}$ W. of it.

The bank, composed chiefly of sand and shells, is rather steep-to on its north-east and south-west sides, depths of 15 and 7 fathoms, respectively, being found at half-a-mile from it.

LIGHT-VESSEL.—A light-vessel, painted red, with *Bahama Bank* on her sides, and carrying one mast with a globe, is moored in 11 fathoms, $1\frac{1}{4}$ mile to the south-westward of the depth of 5 fathoms on the south-east tail of the bank, with Maughold head summit bearing W. $\frac{3}{4}$ S., distant $3\frac{3}{4}$ miles, and Ayre point light N.N.W. $\frac{1}{4}$ W. $7\frac{3}{16}$ miles. From the vessel is exhibited, at an elevation of 38 feet above high water,

a *flashing white* light, showing *two flashes* in quick succession *every half-minute*, and visible at the distance of 11 miles in clear weather.

Fog signal.—During thick or foggy weather a fog siren gives *two blasts* in quick succession *every two minutes*.

Buoy.—A red nun watch buoy lies in 8 fathoms midway between the vessel and the tail of the Bahama bank.

Clearing mark.—Douglas head in sight (open of Clay head), leads $1\frac{1}{2}$ miles southward of Bahama bank.

Ballacash bank, within a depth of 5 fathoms, is 2 miles in length in a north-west and opposite direction, by 3 cables in breadth; its shoalest spot, 7 feet, near the centre, lies with Ayre point lighthouse bearing W. $\frac{1}{2}$ N., distant 5 miles. Depths of 12 to 16 fathoms will be found at a quarter of a mile north-east and south-west of the bank, on which sides it is comparatively steep-to.

The passage between Ballacash and Bahama banks is $2\frac{3}{4}$ miles wide, with depths of 15 to 20 fathoms.

KING WILLIAM BANKS, two in number, and the outermost shoals, lie eastward of Ballacash bank; the western bank is $3\frac{1}{2}$ miles in length in a north-west and opposite direction, with a least depth of 2 fathoms near its centre, with Ayre point light bearing W. $\frac{3}{4}$ N., distant $8\frac{1}{2}$ miles. The eastern bank is one mile in extent, with a least depth of $4\frac{1}{4}$ fathoms, distant $3\frac{1}{2}$ miles S.E. by E. $\frac{1}{4}$ E. from the 2-fathom head on the west bank. There are several spots of $2\frac{1}{2}$ and 3 fathoms upon the western or main bank, and both are steep-to on their south-west sides, depths of 12 to 14 fathoms being found at a quarter of a mile from them.

Buoy.—A spherical buoy, striped red and white horizontally, with staff and diamond, lies in 5 fathoms at the eastern end of the banks, with Ayre point lighthouse bearing W. by N. $\frac{1}{2}$ N., distant 12 miles, and Maughold head summit W. by S. $\frac{1}{2}$ S.

Clearing mark.—Snaefell kept well open southward of North Barrule, bearing W. $\frac{3}{4}$ S., leads south-eastward of King William banks.

Tides.—It is high-water, full and change, at Ayre point, at 11h. 7m. local and 11h. 25m. Greenwich time; springs rise about 20 feet, and neaps 16 feet. The flood stream, from the westward, begins at low water by the shore (which is about the same time as Liverpool), and sets south-eastward over Ballacash and King William banks, for 6 hours. From Ayre point the flood sets southward round Ramsey bay to Maughold head from 2 hours flood to 5 hours flood, setting northward for 9 hours, as mentioned on page 448; *see also* page 16.

Between the point, and the coast of Scotland, at a 10 miles offing, the flood and ebb streams run E. by S. and W. by N., at the rate of about 3 knots per hour at springs, turning a little after high and low water, respectively, at the entrance to Liverpool.

COAST.—From Ayre point the land continues low to Rue point, 3 miles to the westward, off which a spit of sand, with 2 to 6 feet at low water, projects 4 cables; $1\frac{1}{2}$ mile westward of the Rue, abreast of Ballamack Skelly, a small hill 136 feet in height, is the outlet of a small stream named the Leavens; thence to Jurby head the coast rises a little, the summit of Jurby head being 130 feet in height. Jurby church, near it, from being situated on land higher than any about it, shows well from every direction. From Jurby head to Peel castle island, a distance of about 10 miles, the coast curves gradually inwards. The whole of it consists of clay cliffs, varying from 60 to 160 feet in height, backed by the bold slopes of the adjoining mountains. The Killane and Ravensdale streams have their outlets at $1\frac{1}{2}$ and $1\frac{3}{4}$ miles southward of Jurby head.

Jurby rock, with 9 feet at low-water, and about 4 cables off shore, lies about three-quarters of a mile south-west of Jurby head, within the 3-fathom line.

Orrisdale head, 140 feet in height, lies $3\frac{3}{4}$ miles south-westward of Jurby head; half a mile within is Bishops Court, for many centuries the palace of the bishops. Kirk Michael, with its transept and pinnaced tower, half-way between Jurby and Peel, and with a glen on either side, is a fine object viewed from the sea: at $2\frac{1}{2}$ miles south-westward, or half-way to Peel, is Ballaboo point.

Craig rock has a least depth of 13 feet, with 6 fathoms close-to, and lies with Ballaboo point bearing S.E. $\frac{1}{4}$ E., distant $1\frac{1}{2}$ mile, and Peel castle S.W. Kirk Michael touching the fall of the sand-cliffs of Glen Wyllin, bearing East, leads northward of it; and the Calf of Man open of Contrary head, bearing S.W. $\frac{1}{4}$ S., leads westward of it.

PEEL is situated upon the east bank of the outlet of the river Neb*, which rises on the north-east side of South Barrule, and flowing northward, unites, not far from the Tinwald hill, with another stream from the north-east. During the feudal times Peel derived some consequence from its castle, and when the smuggling trade was at its height was a town of importance. Since that period, however, the inhabitants have been chiefly employed in agriculture and fishing, the adjoining sea abounding in cod, haddock, and herring.

The population in 1881 was 4,360.

* See plan of Peel; scale, $m = 6\frac{3}{4}$ inches, on Admiralty chart No. 2,094.

Peel castle occupies a prominent place among the antiquities of the island, and the ruins of it are extensive. It is situated on St. Patrick's isle, a rocky islet 100 yards north-west of the town, and is separated from it by the Neb. The islet is connected to the mainland by a causeway; a bridge also of more recent construction spans the river. The walls of the castle, 3 to 4 feet thick, and flanked by towers, are supposed to have been built in 1500 by the Earl of Derby. They enclose an area of about 5 acres, which is almost covered by the ruins of various buildings which have fallen into decay since the island became vested in the Crown. Within the area are the ruins of two churches; one of them, supposed to have been the first Christian church erected in the Isle of Man, was dedicated to St. Patrick; the other, the cathedral church of Man, dedicated to St. German, was rebuilt about 1245.

Coastguard.—Lifeboat.—There is a lifeboat stationed at Peel, and a life-saving apparatus is kept at the Coastguard station there, the head-quarters of the division on the Isle of Man.

There is a battery and drill shed on the west side of the river, abreast the town.

Supplies, trade.—There are no facilities for repairs of coasting vessels, but moderate supplies, including water, are readily obtained. Agricultural produce and fish are exported; and coal, timber, iron, and general goods, are imported. Peel is a creek of Douglas custom-house.

PEEL HARBOUR, formed by the outlet of the river Neb, is protected eastward by a pier extending in a N.N.E. direction for about 120 yards, having an entrance 50 yards wide between it and the island; this pier is continued inwards for 300 yards by a quay facing the town; the west quay, parallel to it, is 500 yards in length. The inrun into the harbour is partially checked by a breakwater projecting in an easterly direction for about 100 yards from the north-east end of Peel island, and farther in on the same side by a jetty.

The harbour has an area of 4 or 5 acres. The bottom upon the western side is rock and gravel, and over the remainder gravel and sand. Vessels of 12 to 14 feet draught can enter at high-water springs, and those of 8 to 10 feet at neaps.

The great drawback of the harbour is the heavy inrun sent into it in northerly and westerly gales.

LIGHTS.—A *fixed red* light, 27 feet above high-water, is exhibited from a wooden lighthouse at the end of the pier on the east side of

Peel harbour, visible at the distance of 3 miles in clear weather. And a *fixed white* light, 37 feet high, is exhibited from the extremity of the northern breakwater on St. Patrick's isle, the west side, visible from a distance of 5 miles.

Anchorage.—The best anchorage while waiting tide to enter the harbour is in $3\frac{1}{2}$ or 4 fathoms sand, about one cable eastward of the northern breakwater. In case of extremity, run on the smooth beach at the eastern end of the town.

Tides.—It is high-water, full and change, at Peel, at 11h. 8m. local, and 11h. 27m. Greenwich time; equinoctial springs rise $20\frac{1}{2}$ feet, ordinary springs $18\frac{1}{2}$ feet, and neaps $14\frac{1}{2}$ feet.

Directions.—In entering the harbour, having rounded the outer breakwater, which shows a *white* light at night, pass close to the island jetty, and leave the *red* light on the port hand.

TIDAL STREAMS.—West Coast.—Off Jurby head the flood stream sets towards Ayre point at the rate of one knot per hour during springs, gradually increasing in velocity as it approaches the lighthouse: it slacks and turns one hour before high-water. The ebb sets along the shore to the westward, turning one hour before low-water; its rate, one knot at first, gradually decreasing as it approaches Peel, abreast which place there is no perceptible stream. Two miles north of Peel, and beyond, the streams set to and from the point of Ayre; and from 5 to 10 miles W.N.W. from Peel, they set to and from the Calf of Man at the rate of $1\frac{1}{2}$ knot per hour, having even less than that velocity farther to the westward.

To keep in the main stream of flood off Contrary head, Chicken rock should be open of the Stack of the Calf of Man.

Close off Bradda head the stream changes a little before that in Calf sound, viz., 2 hours before high-water by the shore, when it takes a north-westerly direction till it becomes merged in the main stream. Between Niarbyl point and the head an eddy is formed.

COAST.—Contrary head.—From Peel to Contrary head, a distance of $1\frac{1}{2}$ miles, the coast consists of hills varying from 200 to 500 feet in height sloping down to rocky bases. Upon a summit a little to the eastward of the head is Corrins Folly, a square stone building 37 feet high.

The Thistle, a small rock, lies close off Thistle head nearly midway between the castle and Contrary head. The latter headland receives its name from the streams of flood round the south and north coasts of Ireland, meeting a short distance in the offing abreast it.

Niarbyl point lies 3 miles south-west from Contrary head, the coast forming a bight half a mile deep, with the vale and waterfall of Glen Meay or Glenmoif about midway. The coast consists of precipitous cliffs ranging from 100 to 200 feet in height, gradually declining towards Niarbyl point, which is low and rocky, with a ledge extending west about 3 cables from it; with this exception the coast is clear beyond the distance of a cable.

About 3 miles within Niarbyl point is South Barrule, 1,585 feet in height; and half a mile within the shore of the bay to the southward is Cronkny Arrey Lhaa, 1,450 feet in height. South of these hills the land becomes lower.

Between Niarbyl point and Bradda head, 4 miles south-westward, is a bight three-quarters of a mile deep, with depths of 7 to 13 fathoms. The cove of Fleshwick bay, near its south extreme, affords shelter to the fishing boats during south and easterly winds. The coast consists of precipitous cliffs similar to that to the northward, but of greater height, Bradda hill just within it being 766 feet in height.

There is but little stream along the shore between Peel and Bradda head.

PORT ERIN* lies on the south side of Bradda head at about 2 miles from the south extreme of the Isle of Man. It is about 4 cables wide and deep, and shelves gradually from 7 fathoms at the entrance to the fine sandy beach which skirts its head.

Port Erin is directly open to the westward, but receives some protection from the ruins of the breakwater. In all winds from North through east to about S.W. good shelter may be obtained in from 3 to 5 fathoms, over a bottom of sand-coated clay. Milner tower on Bradda head is a conspicuous mark from seaward.

The village, prettily situated along the shore of the bay, is inhabited by fishermen, and frequented in the summer season for bathing. There is a good hotel.

Breakwater.—From the south-west point of the port, just eastward of the Castles rocks, a breakwater, consisting of rough blocks of concrete, extends about 200 yards in a N. by E. direction. Severe gales have caused such damage to it, that several hundred feet of the outer portion is covered at high-water springs, and its extreme at half tide, which has necessitated the removal of the light. A black buoy, in $5\frac{1}{2}$ fathoms, marks the north extreme of the breakwater.

* See plan of port Erin (scale $m=6\cdot75$ inches) on Admiralty chart No. 2,094.

A landing wharf extends eastward along the shore from the butt of the breakwater, with 11 to 13 feet depth alongside at low-water; it has also been partially destroyed.

LIGHTS.—Directions.—Two *fixed red* lights, placed 130 feet apart, and elevated 33 and 52 feet above high water, are exhibited from two wooden lighthouses, painted red, at the head of the port, visible in clear weather from a distance of about five miles. These lights kept in line lead into the port midway between the north extreme of the breakwater and Bradda head.

Beyond a patch of 5 feet, situated 50 yards from the northern shore, abreast the breakwater, there are no dangers. The Sker lies westward of it, the same distance off shore, but it only covers at high water.

A lifeboat is stationed at port Erin.

Tides.—It is high-water, full and change, at port Erin at 10h. 57m. local, 11h. 18m. Greenwich time. Springs rise $16\frac{1}{2}$ feet, neaps $10\frac{1}{4}$ feet.

Coast.—From Port Erin the remainder of the coast of Man to its south-western termination near Kitterland island, a distance of $1\frac{1}{2}$ miles, consists of cliffs from 100 to 300 feet in height. It is foul to the distance of 2 cables, and several half-tide rocks project from the base of the cliff within that distance.

This completes the description of the Isle of Man.

INDEX.

				Page			Page
A.					Aberystwith harbour, lifeboat ...		246
Abbey head ...	...	...	...	411	—, lights ...		246
—, tides ...	...	...	...	412	—, outer anchor- age ...		245
— pill, Neath ...	...	...	...	159	—, tidal signals ...		246
— scar, light ...	...	...	...	373	— town, trade ...		246
— Burnfoot ...	...	...	...	412	Abraham's bosom ...		284
— Hole ...	...	...	...	374	Ae river ...		409
— Holme ...	...	...	...	408	Aeron river ...		242
Aber (mouth of) ...	...	...	...		Afon means a river.		
Aberaeron ...	...	...	...	242	Afon Arto ...		258
Aberamfrach bay ...	...	...	...	255	Afon Avan ...		161
Aberarth ...	...	...	...	242	Afon Liliw ...		135
Aberavan ...	...	...	...	160	African rock ...		295
Abercastel village ...	...	...	...	230	Ainsdale bank ...		361
Aberconway ...	...	...	...	315	Air point, Cheshire ...		323
Aberdaron bay ...	...	...	...	266	Aird point, Nith R. ...		414
Aberdovey harbour, anchorage off				251	Airds bay, Fleet B. ...		422
—, depths in ...	...	...	...	250	Akbar reformatory ship ...		355
—, bar ...	...	...	...	250	Albert tower ...		447
—, beaching ...	...	...	...	252	Alfred pier, Isle of Man ...		437
—, directions ...	...	...	...	251	Allan, port ...		425
—, lifeboat ...	...	...	...	252	—, carreg ...		271
—, lights ...	...	...	...	250	Alldrige shoal ...		172
—, pier... ..	...	...	...	250	Allonby bay ...		402
—, pilots ...	...	...	...	251	Almorness ...		413
— town ...	...	...	...	252	Alney isle ...		215
Abereiddy bay ...	...	...	...	229	Amlwch bay ...		300
—, dangers ...	...	...	...	229	— harbour ...		300
—, directions ...	...	...	...	229	—, coastguard ...		301
Aberfelyn creek ...	...	...	...	231	—, directions ...		301
Aberffraw bay, village ...	...	...	...	282	— dock ...		302
Abergelê road, town ...	...	...	...	320	—, lights ...		301
— lifeboat ...	...	...	...	320	—, pilots ...		301
Abergwaen ..	...	...	...	233	— town ...		301
Abermawr bay ...	...	...	...	220	Amroth church, castle ...		126
Abermenai point ...	...	...	...	276	Amy point ...		40
Abernant ...	...	...	...	160	Anchor head ...		194
Aberporth, coastguard ...	...	...	...	238	Angle bay ...		103
Abersoch bay, lifeboat ...	...	...	...	263	— village ...		103
— village ...	...	...	...	263	— coastguard ...		103
Aberthaw river ...	...	...	...	169	— lifeboat ...		93
—, west ...	...	...	...	169	— shelf ...		98
Aberystwith harbour, depths ...	...	...	...	245	Anglesea, coast of ...		282
—, directions ...	...	...	...	246	— tower ...		312

	Page		Page
Annan	409	Bahama bank, light vessel...	450
— channel	405	Bairnbach islet, pier	193
—, tidal streams	391	Bais bank	227
—, directions	405	—, clearing marks... ..	228
— foot	409	Baithaven	374
—, light	409	Balcary bay, point	412
— river	408	—, lifeboat	412
—, depths in	409	Baldoon sands	420
—, tides	409	Ballaboo point	452
Ansdell	365	Ballacash bank	451
Anvil point	89	Ballamack Skelly	452
Appledore coastguard	62	Balmae head... ..	417
— docks	62	Balmangan bay	418
— pool	61	Baltic rock	442
Arbigland mansion	414	Bangor city, trade	309
Ardwall island	422	— flats	310
Arianrod	274	—, pilots	310
Askew spit, gas buoy	337	— pool	309, 313
Asp rock	63	— port (Penrhyn)	309
Auchencairn bay	412	—, directions	313
— village	412	—, patent slip	310
Auchenmalg bay	430	Bank end	402
Aust head	211	— Nook perch light	365
Avarrack rock	34	Banks Howe	445
Avon river, depths	204	Bankynfeld rock	226
—, light	200	Bann shoal	33
Avonmouth dock	207	Bants Carn	28
—, lights	208	Bar light vessel, Liverpool... ..	336
—, tidal signals	208	Barbara channel	417
Axe river, wharf in	193	—, tidal stream	391
—, directions	193	Bardsey island, light	267
Ayre hook	450	—, dangers around	268
— point, lights	449	—, landing	267
—, banks off	450	—, tugs	268
—, tides	451	— sound, tides	269, 272
		—, directions... ..	270
		Bareness point	421
		Barholm woods	423
		Barhullion Fell	429
		Barlocco caves	412
		— island	422
		Barlochan	413
		Barmouth harbour	253-255
		—, anchorage off	255
		—, Pool	254
		—, directions	255
		—, lifeboat	255
		—, pilots	255
		—, tides	254
		— town	255
		—, quay	255
		—, supplies	255
		Barn scar	389
B.			
Bacas sand	138		
Bach means little.			
Bacon hole	146		
Badrig east pass	256		
—, Sarn	256		
Baggy point, leap	63		
— rock	63		
Bagilt	330		

	Page		Page
Barnhourie sand	414	Bemar bank	256
Barnkirk point, light	409	Ben rock	389
Barnstaple bar	59	Bench rocks, Severn R.	211
— bay	56, 60	Benches	89
— indraught	56	Bendrick rock	171
— buoys	60	Bengairn mountains	412
— directions	61	Benton wood... ..	111
— docks	62	Berkeley	214
— lifeboats	62	— canal	215
— lights	60	— pill	210
— pilots	60	Bernard wharf flat	368
— signals	60	Berrow church	79
— tides	60	— flats	76
— town	62	Bessack rock... ..	38
— depths to	58	Bettys-y-Coed	315
— trade; supplies	62	Bideford bar	59
Barometer, average height of	12	— town, docks	60
Baron hill	307	— depths to	59
Barr point	418	Bidston light	335
Barrels	85	Birkenhead docks	351
Barrow docks, depths to	383, 384	— signals	351
— directions	382	— town	355
— lights	385	Birket stream	334
— leading	381	Bishop rock, light	23
— measured mile	389	— ridge rock	23
— monument	379	Bishop's court	462
— signals	385	Bishops and Clerks	224
— town; trade	384, 385	— general directions	227
Barry dock	170, 171	— tidal streams	226
— directions	171	Bispham	367
— lights	171	Bitches, Jack S.	90
— signals	171	— Ramsey S.	221
— island	171	Black rock, Bridgewater	79
— road	171	— Lundy I.	53
— village coastguard	170	— rocks, Severn R.	211
Barsalloch point	429	— scar	219
Bartholomew ledges	27	— flat	370
Basset islet	40	— Comb hill	387
Bastram shoal	269	— Leg shoal	387
Bath point	310	Blackhorn point	126
Battery hill, Menai	307	Blacknore point	195
— point, St. Ives	35	Blackpool, Pembroke	111
Bazel point	374	— Towy R.	131
Beachley point	211	— Lanc., piers, lights	365
Beaumaris bay, remarks	313	— lifeboat	365
— town	307	Blackshaw flats, spit	417
— anchorage off	313	Blackstones	89
— light	307	Bladenoch river	427
— directions	311-313	— village	428
Beaumont	411	Blaize castle	196
Beckfoot flats	404	Bleadon hill	193
Belan point	276	Blockhouse points	94
Bell rock	225	Blucks pool	112

	Page		Page
Blue Anchor head, road ...	73, 74	Bridgewater, supplies ...	80
Bo Col rock ...	32	———, tugs ...	79
Bo Colloe rock ...	32	Brimstone rock ...	112
Boathaven ...	69	Brisons ...	33
Boblondeb point ...	316	Bristol channel, general remarks, use of the lead ...	1
Boden rocks ...	41	———, currents in the ap- proach ...	13
Bog hole ...	122, 363	———, directions for ap- proaching ...	3, 4
Bola Bleiddyn ...	230	———, ground swell ...	4
Bolivar rock ...	286	———, indraught ...	56
Bootle church ...	334	———, pilots ...	21
Bore, Dee ...	329	———, Refuge anchorage ...	5
——, Parret R. ...	77, 78	———, soundings in the approach ...	2
Borgue church ...	421	———, storm signals ...	12
Borten point ...	255	———, temperature, rainfall ...	12
Borth point, village ...	249	———, tidal streams ...	13-15
Borthwen point ...	253	———, tugs ...	21
Boscastle, coastguard ...	48	———, winds, gale tables ...	8-12
Bosherston church ...	115	Bristol city ...	205
Botallock head ...	34	——— docks ...	206, 207
Botreaux, coastguard ...	48	———, depths to ...	205
Boughton in Furness ...	386	———, directions ...	202, 209
Boulder banks ...	367	———, limits of port ...	204
Bounder rock ...	32	———, river, Avon ...	204
Boverton mill ...	169	———, anchorage ^{over} off ...	201
Bowness village ...	410	———, drill ship, R.N.R. ...	207
Bradda head ...	455	——— training ship ...	201
Braich-y-Pwll head ...	271	Britannia bridge ...	308
Brandon hill ...	205	———, tides ...	277
Braunton burrows ...	57, 63	——— rock ...	281
——— sands ...	59	Briton Ferry dock ...	158
Brazil bank ...	339	———, directions ...	158
Break-o-day hill ...	448	———, lights ...	158
Breaksea light vessel ...	173	———, pilots ...	158
——— point, ledge ...	169	———, above ...	159
———, anchorage ...	169	Broad haven ...	115
Brean Down ...	192	——— sound ...	90
Brecon canal ...	191	———, directions, tides ...	91
Brenin Fawr ...	237	———, Scilly I. ...	27
Brent Knoll ...	78	———, tides ...	29
Bridge, the ...	197	Bromborough town ...	356
Bridgehouse bay ...	421	Broughton bay ...	136
Bridgewater, anchorage in river ...	79	Brow scar ...	408
——— bar ...	76	Brue river ...	76
——— bay ...	75	Bryer island ...	25, 29
———, buoys, directions ...	77, 78	Bryn Awnlwg house ...	248
———, canal to Taunton ...	79	Brynllysten house ...	327
———, dangers ...	76	Buccleugh dock ...	384
——— docks ...	79	Buckish braes ...	57
———, depths to ...	76	——— mill ...	58
——— Mersey ...	358		
———, lifeboat ...	80		
———, lights ...	76		
———, pilots, tides ...	77, 78		

	Page
Bucks ledge	58
Bude haven	48
Bude haven, canal	49
—, coastguard	49
Buggy overfall	68
— pit	68
Bull bay, lifeboat	300
— point, light	64
— rock, Severn R.	210
Bullslaughter bay	114
Buoyage, uniform system	19, 20
—, Liverpool	337
Burbo banks	339
Burgh point	410
Burnham	80
—, anchorage	79
—, directions	78
—, lifeboat	80
—, lights	76
—, pilots	78
—, pier, light	80
—, tugs	79
Burron point... ..	414
Burrow head, race	424
— cliff, cove	435
— nose	68
—, clets of the	435
Burry harbour and port	132
—, depths to	132
—, directions	140
—, docks	132
—, lifeboat	140
—, pilots, tugs	140
—, tides	140
—, trade	133
— holm	136
— inlet	132-141
—, anchorages	139
—, banks in	137, 138
—, buoyage	138
—, channels	138, 139
—, directions	140
—, lifeboat	140
—, lights	140
—, tidal	133, 135
—, pilots, tugs	140
—, tides	140
—, trade	133, 135
Burton quay	130
Bute docks	182-184
Bwch, pen	252
—, sarn-y	253
Bwch-du, pen	230
—, carreg	230

C.

	Page
Cader Idris	248
Cadlan, porth	266
Cadwgan reef	243
Caerlaverock castle	416
Caermarthen bar	128
—, buoyage	129
—, directions	130
—, lifeboat	131
—, tides	130
— bay	117
— tidal streams	117
Caermarthen town	131
—, depths to	128, 131
Caigher point	435
Cairn head	425
Cairnharrow	423
Cairns Muir of Fleet	423
Caldy island, light	118
—, anchorages	122
—, landing	118
— sound and road	119
—, anchorages	122
—, dangers	119-121
—, directions	122, 123
—, tides	121
Calf sound, directions	436
—, tides	436
— rock, Fishguard B.	231
Camel river	44
Camlyn bay, point	298
—, lifeboat	298
Camp hill, Bangor	309
Capstone hill	65
Caraks, the	34
Cardiff docks	182-184
—, depths to	177, 184
—, lights	184
—, storm signals	186
—, tidal signals	185
— flats	184
— grounds	177
—, buoys	178
— hook	178
— pier, light	184
— road (and Penarth)	177
—, anchorages	178
—, dangers in approach	172-176
—, directions	179
—, lifeboat	182

	Page		Page
Cardiff road, pilots, tugs ...	174, 179	Carracks, the... ..	37
—, storm signals ...	186	Carreg or Carreg means a rock.	
—, tides ...	177	— Allan ...	271
— town ...	186	— Bwch-du ...	230
—, pier, low water ...	184	— Chad ...	272
—, supplies ...	186	— Chwislen ...	272
—, trade ...	187	— Coch ...	283
Cardigan bay, remarks ...	241, 248	— Drenog ...	239
—, light vessel ...	241	— Drowy ...	234
—, tidal streams ...	16, 248	— Du ...	266
— island ...	237	— Duon ...	307, 312
— port ...	236	— Dwrbau ...	304
—, bar, depths ...	237	— Dyfed ...	263
—, directions ...	237	— Eilun ...	221
—, lifeboat ...	236	— Fulfran ...	245
— sound ...	237	— Ginnog ...	280
— town ...	238	— Gloyu ...	242
—, depths to ...	237	— Guilan point, rock ...	229
Cardoness obelisk, point ...	422	— Halan ...	281
Cardunock flats ...	408	— Hen ...	284
— village ...	410	— Ina ...	239
Carreg or Carreg means a rock.		— Jordan ...	288
Carew bridge... ..	111	— Llan ...	274
Carleton fell ...	429	— Onnen ...	305
Carlisle city ...	411	— Rhoson ...	225
—, port, tides ...	410	— Rona ...	268
Carlow rock ...	34	— Trai ...	225
Carmel head, beacons ...	298	— Waltog ...	239
— rocks ...	287	— y Chad ...	272
Carn Fawr ...	230	— y Chwislen ...	272
Carn Naun point ...	34	— y trai, S. Tudwall ...	264
Carnarvon, anchorage ...	279	—, Carnarvon ...	272
— bar, directions... ..	278, 279	Carrick rock, P. Vaaish ...	437
—, caution ...	279	— Roayrt ...	447
—, light ...	278	Carsethorn jetty, village ...	414
—, tidal signals ...	278	Carluith burn, castle ...	423
—, tides ...	276	Carters rock ...	41
— bay, light vessel ...	270	Cartford bridge ...	369
—, directions... ..	271	Cartmel wharf bank ...	379
—, drill battery ...	280	Carty quay, tides ...	424
— harbour, light ...	280	—, directions ...	427
—, lifeboat ...	277, 280	Carvellan rocks ...	422
—, patent slip ...	280	Castle bluff, Lundy... ..	53
—, pilots ...	278	— cove ...	48
—, tides ...	276	— head, lights ...	100
— town, trade ...	279, 280	—, Tenby ...	124
—, coastguard ...	280	—, Solway... ..	413
Carnbase shoal ...	28	— pill ...	107
Carnbrae monument ...	40	— light ...	100
Carnellow rock, shoal ...	34	— point ...	114
Carnengyle hill ...	231	—, Fishguard ...	233
Carr rocks and spit ...	99	—, Red wharf ...	304
Carrack Gladdon farm ...	39	— port, Luce B. ...	429

	Page		Page
Castle rocks, Aberystwith ...	245	Chimney rock ...	43
——— Mona ...	443	Chisel rocks ...	76
——— Moor point ...	412	Chronometers, rating of ...	354
Castles rocks, P. Erin ...	455	Church bay ...	286
Castletown ...	439	——— lake ...	107
——— bay ...	438	———, lights ...	101
——— harbour, piers ...	439	——— flats ...	104
———, directions ...	439	Churchtown ...	360
———, lifeboat ...	439	Cistanog ...	131
———, light ...	439	Clarach hill ...	245
———, pilot, tides ...	439	——— patch ...	246
———, trade ...	440	———, vale of ...	246
Caswell bay ...	146	Clarence, reformatory ship... ..	355
Caswenan rock ...	268	Clark wharf sand ...	376
Catherine Hole ...	406	Clay head ...	446
——— scar ...	404	Cleddau river ...	110
Causeway, Menai ...	306	———, tides ...	112
———, S. Badrig ...	256	Clerks ...	225
Cavendish dock ...	385	Clets of the Burrow... ..	435
Cefn-Sidan sands ...	127	——— Sound ...	435
——— y-Bryn ...	146	Clevedon flats ...	195
——— y-Wrach ...	180	——— pier, town... ..	195
Centre ledge ...	176	——— light... ..	195
Cerig-y-Pentwyn ...	252	Clifton, suspension bridge... ..	205
Chapel hill ...	396	"Clio," training ship ...	310
——— isle ...	211	Clipera rocks... ..	289
——— point ...	374	Clovelly pier, village ...	56, 57
——— rock, light ...	210	———, anchorage ...	57
——— rocks ...	97, 170	——— court, lifeboat ...	57
——— Anjou point ...	37	———, light ...	57
——— Roesan bay ...	432	——— road ...	57
Chapman rock ...	58	Clwyd river ...	320
Charstone rock, light ...	210, 211	———, lifeboat ...	320
Chart Agents, list of ...	497, 498	Clyt means a patch of rock.	
Charts, information on ...	xiii	Coal rock ...	295
Cheese stage ...	332	———, beacons ...	298
Chepstow ...	212	Coastguard, District ship, Holyhead	293
———, berthing... ..	212	———, Drill battery, Carnarvon	280
———, depths to ...	209, 212	———, Maryport ...	402
———, directions ...	211, 212	———, Peel ...	453
———, pilots, tides, trade ...	212	———, Tenby ...	125
Cherrystone ledge ...	147	——— ship, Bristol ...	207
Cheshire landing stages ...	352, 353	———, Liverpool... ..	344
——— shore bank ...	341	———, Headquarters of Divi-	
Chester ...	331	——— sions, Ilfracombe	67
———, Crane wharf, Cheese stage	332	———, Liverpool	344
——— bar, buoy ...	326	———, Mumbles	147
———, directions ...	327	———, New Quay	42
———, pilots ...	329	———, Peel ...	453
——— flats ...	324	———, Scilly ...	25
Chicken rock, light ...	435	———, Tenby ...	125
———, tidal streams ...	437	———, Aberporth ...	238
Chicks islets ...	41	———, Amlwch ...	301

	Page		Page
Coastguard, Angle bay ...	103	Coastguard, St. Goven's (Castletank) ...	114
—, Appledore ...	62	—, St. Ives ...	36
—, Bangor... ..	310	—, Scilly I. ...	25
—, Barry	171	—, Sennan cove ...	33
—, Boecastle	48	—, Tenby	125
—, Bude	49	—, Treen cove ...	34
—, Cardigan port ...	236	—, Trevaunance ...	41
—, Carnarvon	280	—, Trevoose head ...	43
—, Clovelly	57	—, Waterloo	343
—, Combe Martin ...	68	—, Weston Super Mare ...	194
—, Croyde	63	—, Westward Ho ...	62
—, Dinas	233	Cobbler patch	75
—, Fishguard	232	Coch, carreg	283
—, Fleetwood	372	Cochra scar	339
—, Flimstone	112	Cockburn rock	199
—, Gwythian	38	Cockerham sand	374
—, Holyhead	293	Cockle Marny rock ...	34
—, Hoylake	343	Cockspeck scar	386
—, Ilfracombe	67	Coldknap point	170
—, Kemmaes	299	Colhugh reef... ..	169
—, Linney head	112	Colwyn bay, village ...	319
—, Little Haven	219	Combe Martin bay, coastguard ...	68
—, Liverpool	343	Combwich pill	79
—, Llangrannwg	238	Compasses, correcting of ...	354
—, Llantwitt	169	—, magnetic disturbance of	23
—, Lynmouth	70	Conheath	415
—, Martinhoe	68	Conigre pill, lights ...	210
—, Maryport	402	Conister rock, tower ...	443
—, Mawgan porth ...	43	Connah's quay	331
—, Milford haven ...	93, 103	Constable bank	319
—, Minehead	73	Constable tinopole cottages ...	160
—, Moelfre	304	Contrary head, tidal streams ...	453
—, Mumbles	147	Conway (Conwy) river ...	314
—, New Brighton ...	343	— channels, sands	315
—, Newport, Cardigan ...	235	—, buoys, directions ...	316
—, New Quay, Cardigan...	240	— town	315
—, —, Cornwall	42	—, tides	316
—, Oxwich head	146	“ — ” school ship	355
—, Padstow	46	Copperas rock	68
—, Peel	453	Copperhouse stream	37
—, Pembrey	133	Corland Fraith	252
—, Penarth	182	Cornah port, telegraph ...	447
—, Pendeen	34	Cornborough summerhouse ...	57
—, Peppercombe	57	Cornwall cape, bank	33
—, port Cardigan ...	236	Corrins Folly	454
—, — Isaac	48	Cors Fochno	249
—, Porthleden	33	Cote light	407
—, Portreath	40	Counan port	429
—, Rhossili	136	Counts channel	210
—, Rhyl	321	Cow rocks	47
—, St. Agnes, Cornwall... ..	41	Cow and Calf	231
—, St. Ann's head	93	Craig rock	452
—, St. David's	219, 224	— Cwbert	236

	Page
Craig Ddrwg... ..	255
— Du	261
— Lais	243
— Roan	414
— y-Cwbert	236
— y-Wilfa	249
Crane islands	40
— wharf, Chester	332
Cranstal point	448
Crasmere	58
Crebinack rocks	23
Cree river	423
— directions	427
— town	423
—, depth to... ..	423
Creswell	111
Cribbin rocks	281
Cribog rock	226
Crickeith castle, town	261
—, lifeboat	261
Criffel hill	414
Crigyll bay	282
—, telegraph cable	283
Crim rocks	26
Crocker pill	205
Cronky Arrey Lhaa	455
Crook peak	193
— scar perch	374
Crosby channel, directions... ..	344, 345
— light	335
— light-vessel	337
Crossens	360
Crow rock, beacon, Pembroke	113
— sound	113
— rock, St. Brides	219
— bar, rock beacon, Scilly	28
— sound, Scilly	28
—, tides	29
— and Sprat ridges	59
Crowan	37
Croyde bay, village	63
Cruggilton castle	425
Crusader bank	361
Crymlyn burrows	157
Culver hole	145
— sand, buoys	80
—, leading marks	81
Cummertrees... ..	416
Cumston castle	419
Cwm Bychan... ..	157
— Tydi	238
Cwywyn	128
Cymmeran bay	282
—, lifeboat	283

D.

	Page
"Dædalus," H.M.S.	207
Dafan sand	138
Dalbeaty	413
Dale road, point, castle	102
Dalpool deep... ..	329
Danger patch, Morecambe	368
— reef	136
Dau means two.	
Daufriach islet	225
—, maen	226
Daullyn island	230
Dean, forest of	214
Dee river, Cheshire, remarks	322
—, anchorages	328
—, bore of	329
—, buoyage	322
—, caution	322
—, channels in 326—328	
—, directions	327
—, lifeboats	322
—, light vessel	323
—, pilots	329
—, tides	329
—, sand banks 323—326	
—, tugs	331
—, upper navigation	330, 331
—, Kirkcudbright	419
—, estuary of	417
—, bar, depths	419
—, buoys	413
—, directions	420
—, lifeboat	419
—, lights	417, 419
Denny islet	199
Derby bay	441
— haven (harbour)	441
—, depths in	442
—, directions	442
—, light... ..	442
Derwent river	396
Derwentwater	396
Devil's bank, Mersey R.	341
— ridge	268
— tail	269
Devonshire dock	384
Dewi-fawr river	128

	Page		Page
Dhoo mount	444	Drummore, bay, point	432
Dial hill	195	———, quay	432
Diffryn moor	258	Du means black.	
Diganwy point	314	Du, carreg	266
Dinas head	233	——, craig	261
———, boat harbour	233	Dubmill point, scar	402
———, coastguard	233	Duddon mouth	386
——— point	43	——— river... ..	386
——— Dinlee	274	———, bar	386
Dingle point	357	———, buoys	387
Dinmor bank	305	———, directions	387
Dinorwic port	280	———, Millom town	386
———, tides	276	Dulas bay, rocks	303
Dione boulders	380	Dumball island, beacons	200
Dockyard bank, Pembroke	99	Dumfries channel	417
——— Royal, Pembroke	108	———, tidal stream	391
Dodd rocks and sand	211	———, depths to	415
Doidon point	47	———, directions	416
Dolwen point	127	———, pilots, tides	415
Doom bar	44	——— town, trade	416
Doon of May	430	Dumroo bank	417
Dornoch burn	409	Dun sand	211
Douglas, I. of Man	446	Dunball brick works	79
——— bay „	442	Dunkerry range	71
———, anchorage	443	Dunragit hill	431
———, dangers	443	Dunraven castle	165
———, promenade pier, light	443	Dunster Gazebo	73
———, tides, pilots	445	Duon, carreg... ..	307, 312
———, Solway	414	Dutchman bank	310
——— harbours, I. of Man	444	Dwrban, carreg	304
———, directions	445	Dwygyfylchi... ..	314
———, lifeboats	446	Dwyryd river... ..	258
———, lights	445	Dyfi river	249
———, pilots	445	Dynlleyn bay or porth	272, 273
———, telegraph	446	———, directions	273
——— head, light	442	———, lifeboat	273
——— river	444	——— point	273
———, Ribble	360	Dysynni river	252
Dove beacon lights	335		
—— cote	68		
Dovey river	249		
Downend	58, 63		
Drenog oliff	243		
Drift rock	119		
Drigg Hawes hills	388		
—— rock	388		
Drill battery, Carnarvon	280		
———, Maryport	402		
———, Peel	453		
———, Tenby	125		
Drill ship, R.N.R., Bristol	206		
———, Liverpool	344		
Drumburgh	410		

E.

“Eagle,” H.M.S.	343
Earlswood hill	157
Earwig flat, bell buoy	324
East bank, Lundy	54
—— island, S. Tudwall	264

	Page
East pool, Burry	140
— rock, Smalls	84
— Freshwater bay	115
— Hoyle bank, buoys	325
— Mouse	300
— Platters... ..	295
— Tarbat bay	431
Eastham Ferry stage	353
— town	356
Eastmoor cliffs	116
Ebal rock	34
Ebbw river	188
Eden river	410
Eel spit	120
Efford beacon	49
Eggersness	426
Egremont pier and slip	352, 353
— town	356
Eilun, carreg... ..	221
—, Pontyr	221
Elegug stacks	114
Ellen river	401
Ellesmere port, docks	359
Ellison scar	404
Elwy river	320
Ely river	180
Endellyon church	47
English channel, stream off mouth	14
—, Solway F.	402
—, banks	402, 403
—, directions	405
—, tidal streams	391
— grounds, light-vessel	197
— Stones, Severn R.	211
Erin port	455
Esk river, Ravenglass	388
—, Solway F.	411
— Meals hills	388
Ethel rock	296
Ewens rock	212
Exmoor	69
Eye beacon, Dee R.	323
— isthmus	435

F.

Fach means little.	
Fairtide rock... ..	212
Fairway shoals, Bristol channel	174

	Page
Fairy rock	163
Far sand bank	404
Farhill scar	380
Fawr means great	
Fechan point	259
Fe-les rock	31
Fenning island	76
Fenwick rock	286
Ferrygoods landing stage	352, 353
Ferryside quay	131
— village	131
— lifeboat	131
Ferrytown-on-Cree	423
Fiddlers, the	120
— ferry	359
Figle Fawr	253
Firefly rock	196
Fish pool	419
Fisher bank, spit	368
Fishermans reef	35
Fishery beacon house	39
Fishguard bay	231
—, lifeboat	232
— harbour	233
— road	232
—, directions	232
— town	233
— bottom	233
Flatholm island	174
—, dangers	175
—, light	175
—, landing	174
—, tugs near	174
— shelf	176
Flatness rocks	196
Fleet bay	422
—, Islands of	421
— water	423
Fleetwood, depths to quays	369, 371
— bar	369
—, buoyage	369
—, directions	370
—, docks	372
—, lifeboat	372
—, lights	369
—, pilots, tides	370
—, tidal signals	369
— town	371
Fleshwick bay	455
Flimby village	398
Flimston bay	114
— head	112
—, coastguard	112

	Page		Page
Flint	331	Garland stone	88
Foel Goch hill	235	Garliestown pier, town	426
— Wyllt	248	—, anchorage off	426
Fogs, caution	18, 19	Garnfach hummock	229
Foreland ledge	70	Garreg village	249
—, tidal streams	71	Garron pill	111
Forhyd stream	278	Garston docks, signals	357
Forest of Dean	214	Garth ferry, Menai	308
Formby bank, spit	340	Gateholm bay and island	88
— channel, buoys	348, 349	Gatehouse bridge	422
—, directions	349	— town	423
— church	334	Gavorne, port	48
— deep	349	George's landing stage	352, 353
— light-vessel	336	Giant's grave quay	159
— point, tower	334	Gibbs hole	413
— pool	349	Gileston rectory	169
"Formidable," training ship	201	Gilman point	127
Fort island, Isle of Man	441	Gilpin river, viaduct	378, 379
Foulney island	380	Giltar point, spit	117, 120
Four Fathom bank	314	—, Proud	117
— Fathoms tongue	339	Gimlet rock, shoals	262
Foxdale mines	433	Ginnog, carreg	280
Framilode	209	Ginst point	128
Freckleton	365	Glamorganshire canal	182
Fremington	58	Glas point	272
Frenchman rock	418	Glaslyn river	258
Freshwater bay, Pt. Lyns	303	Glass mount	444
—, West	112	Glasserton highlands	429
—, East	115	Glasson dock, tidal light	375
Friar's bay	307	—, directions	374
— bank	310	—, tides	373
— road, directions	275, 312	Glen Meay	454
Frongoch point	251	— Moif	454
Furness bank	379	— Wyllia	452
		Glencaple quay	415
		Glenluce abbey	431
		— church, sands	430
		— village	431
		Glenthorn house, landing	71
		Glossary	xi-xii
		Gloucester city	215
		— canal, docks	215, 216
		—, depths to	209, 215
		—, pilots	210
		—, supplies, tides, bore	216
		Godrevy head	38
		— island, lights	38, 39
		— sound	39
		Gold cliff	192
		Gomer rock	259
		Goodern bight	40
		Goodic pier, sands	232
		—, lifeboat	232

G.

Gafaeliog rock	222
Gale tables	10-12
Gallantry bower	56
Galloway, mull of, light	431
Gallows point	308
—, tides	276
Gannet stone	53
Ganol rock	229
Garheugh craigs	430

	Page		Page
Hgy	212	Holyhead harbours, coastguard ...	293
Hayle bay	44	—————, directions ...	291, 292
——— estuary	37	—————, docks... ..	293
——— bar, buoys	37	—————, lifeboats	293
———, lifeboat	38	—————, lights, fog sig-	
———, lights, tidal	37	————— nals	290
———, pilots	37	—————, pilots, tugs ...	291
———, supplies	38	—————, storm signal... ..	293
Hay, Wye R.	212	—————, tides	290
Hayward rock, light near ...	210	————— island	283
Hazelbeach lights	101	————— mount	283
Head hotel, Douglas	442	————— town, supplies ...	292, 293
Hean castle	126	————— Inner harbour ...	288
Heddons mouth	69	————— Old harbour	287
Helesborough hill	65	————— Refuge harbour... ..	287
Hell bay	5	Holywell head	41
——— mouth	266	Honeycomb rock	193
Helwick pass... ..	143	Hooper sand	197
———, sands, buoys	143	Horse bank, Ribble R. ...	361
———, directions... ..	144	——— channel, buoys ...	346
———, light-vessel	144	———, directions... ..	347
———, swatch	143	———, lights	334
Hen, carreg	284	———, tidal signal	347
Hen and Chickens	53	———, tidal streams ...	346
Henborth bay	298	——— islet	40
Henfynyw church	243	——— rock, Jack S.	90
Mercurianum dock light ...	354	———, Ramsey S.	221
Hermon mount chapel	141	Horseshoe bank	45
Hesketh bank town	360	——— flat	196
Hestan bay	412	——— pool	201
——— island	413	Horton village	145
Hevah rock	39	Hottentot kraal	396
Heysham lake, anchorage ...	366, 376	Hotwells	204
———, directions	370	How rocks	192
High Barrow peak	136	Hoylake, beaching near ...	334
——— Bridge	80	——— light	334
Highcliff bank	121	———, lifeboat	343
——— point	118	——— sand	338
High Pennard	146	Hoyle banks	324, 325
High Weer point	69	Hubberston observatory ...	98
Hilbre islets, telegraph ...	323	——— point	95
——— swash, directions ...	328	Hugo bank	150
Hilpsford shoal	381	Humphrey head	379
Hobbs point wharf	102	Hundred end... ..	333
Hoe rock	36	Hurlstone point	72
Holiday hill	68	Hygre, or Bore of Severn ...	216
Holms, the	204		
Holyhead bay, anchorage ...	286		
———, dangers in	288, 289		
———, tidal streams	290		
——— harbours, inner	288		
———, outer	287		
———, beaching	292		

I.

	Page
Iago, porth	272
Ilfracombe, harbour... ..	65, 66
—, directions	67
—, lifeboat	67
—, lights	66
—, pier	66
—, pilots	66
—, range anchorage ..	66, 67
—, supplies	67
—, tides	66
—, town	65
Ina point, carreg	239
Ince ferry	333
Inch islet	418
"Indefatigable," training ship ...	355
Indraught, Barnstaple bay ...	56
—, Cardigan bay	241
Information relating to charts and sailing directions... ..	xiii
Inkley point	76
Inner channel, Gynfelin	247
— passage, Dee R.	328
— Platters	289
— road, St. Tudwall	265
Innerwell port, point	427
Instow	62
Inward point, light... ..	210
Irby hill	333
Irish sea, southern approach, general remarks, use of the lead	1
—, currents in the approach	13
—, directions for approaching	5
—, indraught to Cardigan bay	16, 241
—, pilots	21
—, refuge harbours	7
—, soundings in the approach	2
—, storm signals... ..	12
—, temperature, rainfall	12
—, tidal streams	15, 17
—, tugs	21
—, winds, gale tables... ..	8-12
Irishman spit	310
Irt river	388

	Page
Isaac, port	47
Isaf means low.	
—, llech	226
— rock	229
Islands of Fleet	421
Isle of Man, general description ...	433
—, banks off	450, 451
—, climate	434
—, government	434
—, population, trade	434
—, tidal streams	436, 439, 445, 451, 454
—, telegraph cable ..	446
— Whithorn	425
Ivel river	76

J.

Jack sound	89
—, dangers	89, 90
—, directions	90
—, tides	90
Jacob's pill,	104
Jenny cove	53
Jordan bank	339
—, carreg	288
Jubdale creek	435
Jurby head, church, rock	452
—, tidal streams	454

K.

Kallow point... ..	437
Keer river	379
Kellan head	47
Kelsey head	41

	Page		Page
Lifeboat, Air point ...	343	Lifeboat, Peel ...	453
—, Aberdovey ...	252	—, Penarth ...	182
—, Abergelé ...	320	—, Penmon ...	311
—, Abersoch ...	263	—, Piel ...	383
—, Aberystwith ...	246	—, port Cardigan ...	236
—, Angle point ...	93	—, port Dnylleyn ...	273
—, Appledore ...	62	—, port Eynon ...	145
—, Balcary bay ...	412	—, port Isaac ...	48
—, Barmouth ...	255	—, port Madoc ...	261
—, Blackpool... ..	365	—, Porthcawl ...	165
—, Borth ...	249	—, Prince's stage ...	343
—, Braunton sands ...	62	—, Ramsey harbour... ..	449
—, Bude ...	49	—, —, sound ...	224
—, Bull bay ...	300	—, Rhosneigr ...	283
—, Burry port ...	140	—, Rhyl ...	321
—, Camlyn B. ...	298	—, Ribble R....	364
—, Cardigan port ...	236	—, Roe island ...	453
—, Carnarvon ...	277, 280	—, Saint Anne's ...	364
—, Castletown ...	439	—, Scilly I. ...	25
—, Clovelly ...	57	—, Seascale ...	389
—, Clwyd R. ...	321	—, Sennan cove ...	33
—, Crickeith ...	261	—, Silloth ...	407
—, Cymmeran bay ...	283	—, Solva ...	219
—, Dee R., Cheshire ...	322	—, Solway F....	394, 402
—, Douglas ...	446	—, Southport ...	363
—, Dynlleyn ...	273	—, Talacre ...	322
—, Fishguard ...	232	—, Tenby ...	125
—, Fleetwood ...	372	—, Trevor port ...	274
—, Goodie ...	232	—, Watchet ...	75
—, Gwydir ...	274	—, Weston Super Mare ...	194
—, Holyhead... ..	293	—, Whitehaven ...	394
—, Hoylake ...	343	—, Whithorn ...	425
—, Ilfracombe ...	67	Life-saving apparatus ...	13
—, Hilbre island ...	343	Lightning knoll ...	381
—, Kemmaes B. ...	299	Lights, Aberdovey ...	250
—, Kirkcudbright ...	419	—, Aberystwith ...	246
—, Little Haven ...	219	—, Amlwch ...	300
—, Liverpool... ..	322, 343	—, Annan ...	409
—, Llanaelhaiarn (Gwydir) ...	274	—, Avonmouth ...	200
—, Llanddwyn I. ...	277, 280	—, Ayre point ...	449
—, Llandudno ...	319	—, Bardsey I. ...	267
—, Llandulas... ..	320	—, Barrow ...	385
—, Lynmouth ...	70	—, Barry dock ...	170
—, Lytham ...	364	—, Beaumaris ...	307
—, Maryport ...	402	—, Bideford ...	60
—, Menai strait ...	277, 280, 311	—, Blackpool ...	365
—, Moelfre ...	304	—, Briton Ferry ...	158
—, Morte bay ...	64	—, Bull point ...	64
—, Mumbles ...	147	—, Burnham or Bridgewater ...	76
—, New Quay, Cardigan ...	240	—, Burry inlet... ..	133, 135, 140
—, —, Cornwall ...	42	—, Caldý I. ...	118
—, Newport, Cardigan ...	235	—, Cardiff ...	184
—, Padstow ...	46	—, Carnarvon ...	279

	Page		Page
Lights, Castletown ...	439	Lights, Ribble ...	361, 363, 364
—, Chicken rock ...	435, 436	—, St. Ann's head ...	93
—, Clevedon ...	195	—, St. Anne's-on-Sea ...	364
—, Clovelly ...	57	—, St. Bees head ...	392
—, Cote ...	407	—, St. Ives ...	36
—, Dee (Kirk) ...	417, 419	—, St. Tudwall's ...	264
—, Derby haven ...	442	—, Saundersfoot ...	126
—, Douglas ...	445	—, Scilly islands ...	23, 24
—, head ...	442	—, Severn R. ...	210
—, Flatholm ...	174	—, Silloth ...	407
—, Fleetwood ...	369	—, Skinburness (Cote) ...	407
—, Godrevy ...	38	—, Skerries ...	294
—, Great Orme ...	316	—, Smalls ...	84
—, Gwydir (port Trevor) ...	274	—, South Bishop ...	224
—, Harrington ...	395	—, Southport ...	363
—, Hartland ...	49	—, South Stack ...	285
—, Hayle ...	37	—, Stanner point ...	361
—, Holyhead ...	290	—, Swansea ...	154
—, Ilfracombe ...	66	—, Tenby ...	125
—, Kirkcudbright ...	419	—, Trevoise head ...	43
—, Langness ...	440	—, Usk R. ...	189
—, Laxey ...	446	—, Walney I. ...	380
—, Lee scar ...	407	—, Watchet ...	74
—, Lit. Ross island ...	417	—, Whitehaven ...	393
—, Liverpool ...	334-337	—, Workington ...	397
—, Llanddwyn ...	277	—, Wyre R. ...	369
—, Llandudno ...	318	Light-vessels, general remarks on ...	20
—, Llanelly ...	135	—, riding lights, signals ...	20, 21
—, Longships ...	31	—, Bahama bank ...	450
—, Lundy I. ...	52	—, Breaksea ...	173
—, Lune R. ...	373	—, Cardigan bay ...	241
—, Lytham ...	361	—, Carnarvon bay ...	270
—, Lynus point ...	302	—, Dee R. ; Cheshire ...	323
—, Maryport ...	400	—, English and Welsh	
—, Menai ...	306	—, grounds ...	197
—, Milford haven ...	93, 100	—, Helwick ...	144
—, Minehead ...	72	—, Liverpool ...	336, 337
—, Morecambe ...	377	—, Solway ...	404
—, Mull of Galloway ...	431	—, Morecambe bay ...	366, 376
—, Mumbles ...	147	—, Scarweather ...	150
—, Nash point ...	166	—, Selker rocks ...	388
—, Neath ...	157-159	—, Sevenstones ...	30
—, New Quay, Cardigan ...	239	Lidstip ledge... ...	120
—, Padstow ...	46	Ligger bay ...	41
—, Penrhyn ...	309	Limekiln point ...	136
—, Peel ...	453	Limewharf flat ...	323
—, Piel ...	380, 381	Lincluden abbey ...	416
—, port Erin ...	455	Linney head ...	112
—, St. Mary ...	438	Liscard town... ...	366
—, Porthcawl ...	164	Little head ...	444
—, Portishead ...	200	—, Bo rock ...	32
—, Ramsey ...	448	—, Stoke spit ...	75
—, Rhyl... ...	321	Littleleness ...	442

	Page		Page
Little Burbo bank	339	Llanbedrog point, church	263
—— Hangman hill	68	Llanddewi church	243
—— Haven	219	Llanddwyn island	277
—— lifeboat	219	——, lifeboat	277
—— Milford quay	111	——, light, pilots	278
—— Narles rocks... ..	374	Llandimore marsh	136
—— Orme head	319	Llandisilio islet	281
—— Ross island, light	417	Llandonna church	304
—— Scare rocks	429	Llandudno	318
—— Tor	146	—— pier, lights	318
Liverpool bay	332	Llandulas, lifeboat	319, 320
——, aspect	333, 334	Llanduloch	238
——, beaching	334	Llanegan mill	263
——, buoyage	337	Llanelly	133
——, coastguard	343	—— harbour and docks	134, 135
——, directions	344-348	——, anchorages	139, 140
——, approach- ing	5, 296	——, channel to	141
——, dredgings buoy	339	——, directions	140, 142
——, lights	334-337	——, light	135
——, light-vessels	336	——, pilots	140
——, lifeboats	322, 343	——, storm signal	135
——, pilots	342	——, tides	140
——, sand banks in	338-340	——, trade	135
—— city	350	Llangennech quay	139
——, chronometer rating	354	Llangenydd burrows	136
——, compass cor.	354	Llangollen, vale of	322
——, communication	354	Llangranwg, coastguard	238
——, docks, signals	350-352	Llangwyffen point	284
——, directions	346-349	Llanlana cove, head	299
——, landing stages, ferries	352	Llanllawer hill	231
——, landing stages, lights	353	Llanmadoc hill	136
——, lifeboats	322, 343	Llannerch-y-mer	330
——, lights	353	Llanrhidian marsh, sands	136
——, nautical institutions	355	Llanrhystyd	243
——, port limits	333	Llansaint church	129
——, pilots	342	Llansantffraid	243
——, telegraph signal stations	285, 302, 317, 321, 323, 435	Llanstadwell... ..	104
——, tides	341	Llanstephan castle	129
——, time signal... ..	354	—— village	128
Liverpool and Leeds canal... ..	354	Llantwitt, Major, coastguard	168
Llaeithy peak	228	Llawlell hills	255
Llam-y-carw point	301	Llawndy gut... ..	330
Llan means area, church.		Llech means a flat stone.	
Llan, carreg	274	—— Isaf	226
Llanaelhaiarn	274	—— Uchaf	226
Llan Ishmael church	128	Llechau Cochion	229
Llanaber church	256	Llechryd bridge	237
Llanbadrig village	299	Llethr peak	248
		Lliedy river	133
		Llifon stream	274
		Llochtyn point	238
		Lloyd's signal stations	21
		——, pilot vessel... ..	24

	Page		
Marisco castle	51	Menai strait, south-west entrance,	
Marros church, hill	127	light	278
Marsh bridge	207	—, south-west entrance,	
Martins haven point	96	tides	275, 276
Marton Mere	363	Menewethan islands	23
Maryport, Dumfries	412	Merope rock	43
—, Luce bay... ..	431	Merran rock	36
—, Solway F.	399-402	Merse, the	414
—, banks off... ..	402, 403	Mersey river, general remarks	332
—, directions	401	—, anchorages	347, 348, 349
—, docks, slip	400	—, banks in	340
—, harbour	399	—, batteries	350
—, lifeboat	402	—, buoyage, system of... ..	337
—, lights, tidal	400	—, depths in	332
—, pilots, tugs	401	—, directions, approach-	
—, road	399	ing from westward 5, 296	
—, directions... ..	405	—, directions, Formby	
—, tides	401	channel	348, 349
— town, supplies	401, 402	—, directions, Horse	
Mathern cliff... ..	210	channel	346
— oaze	211	—, directions, Queen's	
—, upper pill	212	channel	344, 345
Maughold, church, head	447	—, directions, Rock	
Maw or Mawddach river	253	channel	346
Mawgan porth, coastguard	43	—, docks (<i>see</i> Liver-	
Mawr means great.		pool)	350-352
Meachard rock	48	—, ferries and lights 352, 353	
Measured mile, Barrow	389	—, lifeboats	343
—, Liverpool	334	—, lights, gas buoys 334-337	
Melyn head	300	—, regulations	
Menai light	306	for carrying	348
— strait, general remarks 274, 275		—, measured mile	334
—, bridges	308	—, pilots... ..	342
—, buoyage	279, 310	—, port limits	333
—, directions 279, 282, 311-313		—, quarantine ground... ..	348
—, lights	278, 306	—, sand banks in	
—, pilots	278	approach	338
—, Swellies	281	—, telegraph signal	
—, tides	275-277	stations	285, 317, 323
—, north-east entrances 305		—, tides, streams	341
—, north-east entrances,		—, upper, depths	356
buoys	310	—, ports in	357-359
—, north-east entrances,		—, powder hulks	357
directions	311-313	—, remarks on	333
—, north-east entrances,		—, tides	359
lights	306	—, tugs	358
—, north-east entrances,		— rock	86
tides	277	Mewdwy, porth	267
—, south-west entrance 277		Mewsford point	114
—, south-west entrance,		Mewstone	88
bar	298	Mid isle, Jack sound	88
—, south-west entrance,		Middle bank, Solway F.	408
directions	279	— channel rocks	96

	Page		Page
Middle ground, Bridge, Bristol C.	198	Minehead harbour, pilots ...	73
— Mouse ...	299	— town, supplies ...	72, 73
— sand, Burry inlet ...	137	Mite river ...	388
Middlehope beach ...	195	Mixon shoal ...	148
Middleton tower ...	370	Mixons ledges, Severn R. ...	211
Midlake swatch ...	310	Moar port ...	447
Milford haven, above dockyard	110, 111	Mochras island, creek ...	258
—, anchorages...	101, 102	— spit ...	256
—, aspect of ...	94	Mochrum Fell ...	430
—, batteries ...	95	Mockbeggar wharf bank ...	338
—, capabilities ...	95	Moel means bare, conical hill.	
—, communication ...	110	Moel Badell ...	238
—, dangers, buoyage ...	95-99	— Gest ...	260
—, deep water wharves		— Hebog ...	257
—, directions ...	102, 107	— Llyn ...	248
—, directions for ap-		— Saesiog... ..	320
proaching... ..	91, 92	— Ynys ...	252
—, docks ...	108, 110	Moelfre islet, road ...	304
—, dockyard, H.M. ...	109	— lifeboat ...	304
—, ferries ...	109	— mountain ...	255
—, general remarks ...	94, 95	— village ...	304
—, lifeboat ...	93	Moelyn rock... ..	226
—, lights ...	93, 100	Moffat river ...	409
—, pilots, tugs ...	101	Mona castle, I. of Man ...	443
—, repairs ...	108, 110	— mill, Amlwch ...	301
—, supplies ...	108, 109	Monkey rock ...	229
—, telegraph ...	93, 109	Monkstone, beacon, Cardiff	176
—, tides ...	101	—, Tenby ...	124
—, torpedo ground ...	103	Monmouthshire canal ...	191
—, trade ...	110	Monreith bay, village ...	429
—, Trinity estab. ...	109	Moor Quie rock ...	43
— dock, ...	108	Morecambe bay, anchorage	366
—, lights ...	100, 108	—, directions... ..	370
—, signals ...	108	—, light-vessels	366, 376
— reach lights ...	100	—, pilots ...	370
— road ...	102	—, sands in ...	367, 368
— shelf ...	98	—, tides ...	370
— town ...	107	— harbour, lights	376, 377
—, supplies, trade	109, 110	—, depths in ap-	
Mill bay, Anglesea ...	298	proach ...	376
—, Pembroke.. ..	96	—, directions	370, 378
Millom town... ..	386	— town ...	378
Millton sands ...	418	—, estuary above ...	378
Milner tower... ..	455	Morfa Bychan spit ...	259
Milnthorpe sand, viaduct ...	379	— Dyffryn ...	256
Minalto rock, great ...	28	Moricambe bay, Solway F. ...	408
Mincarlo rock ...	27	Morlais castle ...	162
Minchew hole ...	146	Mort bank ...	379
Minehead bluff ...	72	— flat and scar ...	380
— harbour ...	72	Morte bay, village ...	63
—, directions ...	73	—, lifeboat ...	64
—, light ...	72	— point and stone ...	64
		Mostyn bank, buoys ...	326

	Page		Page
Mostyn deep	328	Neath, pilots, tugs	158
— quay... ..	330	— river, estuary	157
Mouls island	47	—, wharves, depths at	159
Mouse, east	300	Needle rock	53
—, middle	299	Neigwl (Nigel) porth	266
—, west	295	Nelson statue, Menai	280
Mozen rocks	34	Netherwood	415
Mull of Galloway, light	431	Nevern river	234
—, race off	428	Nevin bay	273
—, tidal streams	428	New channel, Neath	159
— Senniess	430	— cut, Bristol	205
Mumbles head, light	147	—, Swansea	156
—, coastguard	147	— patch	175
—, lifeboat	147	— quay, St. Goven's	115
—, signal station	147	— Brighton landing stage	352, 353
— road	153	— coastguard	343
— village	147	— town... ..	356
Muncraig heughs	421	— England bay	432
Murray isles	422	— Ferry stage	353
Mussel hill, Conway R.	314	— Grimsby harbour, tides	24, 29
Mynydd Bychan	250	— Milford	109
— Dinas	160	— Passage (Severn)	211
— Tir-y-Cwmwd	263	— directions	211
		— Quay bay (Cardigan)... ..	239
		— directions	239
		— harbour	240
		— light	239
		—, lifeboat	240
		—, patent slip	240
		— (Towan), bay	41
		—, coastguard	42
		—, lifeboat	42
		— tidal harbour	42
		— town	42
		Newcombe shoal	199
		— knoll	338
		Newland islet	44
		Newport bay, Cardigan	234
		—, lifeboat	235
		—, Nevern river	234
		— sands	234
		— town	234
		—, Usk R., approach to	188
		— road or deep	189
		—, banks in approach	189
		—, directions	190
		—, light, Usk R.	189
		—, pilots, tugs	190
		— docks	191
		—, depths to	188
		—, lights, signals	192
		—, tides... ..	190
		— town	190

N.

Nanjulean mill	33
Nash passage, directions	168
— point, lights	166
— sands	166, 167
—, buoys	167
—, clearing marks	168
Navax point	40
Navigation of H.M. ships, information on	xiii
Neath Abbey coal bank	159
Neb river	453
Neath	160
—, canal to Swansea	159
—, channel depths to	157
—, buoyage	157
—, directions	158, 159
—, docks	158, 159
—, lights	157-159
—, new channel	159
—, signals	160

	Page
Newport town, repairs, supplies	191, 192
— trade...	192
Newton village	165
— Down mill	162
— Nottage village	165
— Knot hill	388
— Noyes pier	107
— Stewart	424
Neyland or New Milford, landing	
— pier	100
— ferry	109
— lights	100, 101
— railway pontoon	95, 102
— village	109
Niarbyl point	454
Nith river, depths in	415
— directions	416
— pilots, tides	415
Nix hollow	362
Noetham dam	205
Nornour islet...	28
North bank, Liverpool bay...	339
North bank, Solway F.	403
— channel, directions	8
— tidal streams	17
— Ribble R.	362
— Scilly I.	28
— tides	29
— haven, I. of Man	434
— Skomar	88
— Barrule hill	447
— Bishop...	225
— Meols	360
— Stack, fog signals	285
— wharf flat	368
— Wall light	335
— east entrance, Menai S.	305, 312
— directions	312
— rock, Smalls	84
— west bank, Lundy	53
— entrance, Menai S.	306, 311
— directions	311, 313
— patch, Dee R.	324
— patches	75
— light-vessel	336
Northam burrows	57
Northwich, canal to	359
Nose point	129, 266
Nundeepts rocks	23
Nunnery Howe	442
Nut island	26
Nymphe bank	2

O.

	Page
Oer, porth	272
Offing patches	119
Ogmore down, river	165
Ogwen river	309
Oil on breaking waves	xxii
Old dock sill, Liverpool	341
— scar, Morecambe	377
— Castle head	116
— Grimsby harbour, tides	24, 29
— Passage, directions	211
— Wall rocks	59
— wreck rock	28
Oldbury sand	213
Onchan bight	445
One-fathom bank	173
Onnen, carreg	305
Orchards patch	180
Orchardtown bay	427
Ord points	118
Orme bay	318
— head, great, light	316, 317
— telegraph	317
— little	319
Orraland bay	412
Orrisdale head	452
Otterham rock	48
Outer patch, Gynfelin	247
— Platters	288
— road, Menai S.	311
— directions	311, 313
— St. Tudwall's	265
Oxwich head and bay	146
— coastguard	146
Oyster bank, St. Tudwall's	263
— grounds, Morecambe	367
Oystermouth castle and village	148

P.

Paddock spit...	129
Padstow bay	43
— dangers	44
— harbour	44

	Page		Page
Padstow harbour, bar ...	44	Pen Clawdd village ...	137
—, coastguard ...	46	— Cribach ...	238
—, day mark ...	44	— Cwningen ...	245
—, directions ...	45	— Dinas Llochtyn ...	238
—, lifeboat ...	46	— Gyby ...	283
—, pilots, tides ...	45	— Pygyn ...	243
— tidal harbour ...	46	— Trwyn ...	318
—, light ...	46	Pen-y-Bal ...	234
— town, supplies ...	46	— chain ...	261
Pages pill ...	59	—, shoals ...	262
Palnackie ...	413	— Dinas, hill ...	243, 244
Palnure, depth to ...	424	— Gloyn ...	242
Paris mount ...	301	— holt stack ...	112
Park head ...	42	— Kil ...	266
Parkgate, Dee R. ...	330	— Sarn ...	320
Parret river ...	75	— wig point ...	240
Parton craigs ...	422	Penally church ...	117
— village ...	395	Penarth head ...	172
Pater fort ...	109	—, lifeboat ...	172, 182
Peaked rock ...	26	— dock, harbour ...	181
Peal point ...	31	—, depths to ...	181
Peden Mean-du point ...	32	—, signals ...	182
Pednathias head ...	23	— flats ...	184
Peel castle ...	453	— road ...	172
— harbour ...	453	—, storm signals ...	186
—, anchorage off ...	454	— town, pier ...	182
—, directions ...	454	—, supplies ...	182
—, lifeboat ...	453	Penberry peak ...	228
—, lights ...	453	Penbrush point ...	228
—, tides ...	454	Pencarnen point ...	221
Pembrey old harbour ...	133	Penclegyr ...	229
— coastguard ...	133	Pendeen cove, point ...	34
— pool ...	140	—, coastguard ...	34
— village ...	133	Pendine heights, sands ...	127
Pembroke castle ...	94	Pengarn mount ...	286
— dock town, docks ...	108, 109	Penglais house ...	243
—, anchorages ...	104	Penhale point ...	41
—, pilots ...	101	Penkilan head ...	263
— dockyard ...	109	Penlas islet ...	281
—, signal stations ...	93, 109	— rock or islet ...	284
—, bank ...	99	Penmaen swatch ...	310
—, deep water ...		— Mawr, point ...	309
— wharf ...	109	— Melyn ...	219
— reach ...	102	— Bach point ...	314
—, directions ...	105	Penmon bay ...	307
—, lights ...	100	Pennar flats ...	98
—, swatchway ...	99	— mouths ...	103
— town quay ...	104	Pennard pill ...	146
Pen means a head, or high point.		Penpole tower ...	196
— Anglas ...	231	Penrhiw house ...	243
— Bwch, beacon ...	252, 253	Penrhos bay, point ...	284
— Caer ...	230	Penrhyn du ...	263
		— castle ...	309

	Page		Page
Penrhyn point	254, 307	Porlock bay, village	71
—— port	309	—— weir	72
——, directions	313	Port Cardigan	236
——, lights	309	—— Carlisle	410
Penrhyngwm point	137	—— Castle	429
Penrice church, castle	146	—— Cornah, telegraph	447
Pentire head	46	—— Counan	429
—— points	41	—— Erin	455
Peppercombe	57	——, breakwater	455
Perleze rock	43	——, directions	456
Perran bay, porth	41	——, lifeboat	456
Peterston village	180	——, lights	456
Peterstone flats	189	——, tides	456
Pewshiw house	243	Port-e-Vada	443
Pibeo rocks	289	—— Innerwell	427
Picton point	110	—— Isaac	47
Piel bar	380	——, coastguard	48
——, anchorage off	382	—— Gavorne... ..	48
—— castle	380	—— Madoc. <i>See</i> Madoc	258
——, channel above... ..	382	—— McGean... ..	427
—— harbour, depths	380	—— Mary, Solway F.	412
——, buoyage	381	—— Moar	447
——, directions	382	—— Penrhyn	309
——, lights	380	—— Quin and bay	47
—— leading	381	—— St. Mary	437
——, lifeboat	383	——, directions	438
——, pilots, tugs	382	——, lights, tides... ..	438
—— island	380	—— Soderick	442
—— pier, light	382	—— Talbot	160, 161
Pill, Avon R.	205	——, directions	161
Pilling sand	374	——, pilots, tugs	161
Pilotage, H.M. ships	21	——, trade	161, 162
Pilots, Bristol channel	21	—— Trevor (Gwydir)	274
——, Irish	22	—— William... ..	429
Piltanton burn	431	Porth means a port, harbour.	
Platters, Menai	281	—— Bach point	263
——, east, west, Skerries	295	—— Cadlan	266
——, inner, Holyhead	289	—— Dynlleyn	272
——, outer,	288	—— Eynon bay, head	145
Pleasant, mount	98	—— lifeboat	145
Plover scar, light	373	—— Gynfor	300
Pluckington bank	340	—— Helygon	303
Point of Ayre	449	—— Iago	272
Pole rock	112	—— Kidney sands... ..	37
Poll bank	23	—— Leden, coastguard	33
Pollard rock	30	—— Llechog	300
Pollards rock... ..	43	—— Llongdy	305
Polpry point	33	—— Mewdwy	267
Pont means a bridge.		—— Neigwl	266
Pontyr Eilun	221	—— Oer	272
Pool quay, Severn R.	209	—— Perran, coastguard	41
Popit	237	—— Solach	267
Popton point, fort	95	—— Towan, coastguard	41

	Page		Page
Ramsey sound, directions ...	223	Ribble river, gut channel ...	361
———, lifeboat ...	224	———, directions ...	362
———, tides ...	223	———, north channel ...	362
Ranie spit ...	173	Richardson rock ...	417
Rascarrel bay ...	412	Ridge, Scilly ...	26
Rat island ...	53	Ridgeway ...	117
Rattles bay ...	55	Rigg bay ...	426
Ravenglass harbour...	388	Rillage point ...	68
———, directions ...	389	Ring scar ...	377
Ravensdale stream ...	452	Ringdow point ...	422
Ravenshill cliff ...	423	Rip Rap, buoy ...	344, 346
Razor bank ...	45	Rivel mountain ...	273
Red cliff, Wye, R. ...	212	Robin Rigg sand ...	403
—— pier, Douglas ...	444	Rock channel, buoys ...	346
—— Crae bridge ...	419	———, anchorage ...	347
—— Jacket pill ...	159	———, directions ...	347
—— Ord point ...	118	———, lights ...	334
—— Wharf bay ...	304	———, tidal signal ...	347
Redbrook ...	212	———, streams ...	346
Redkirk ...	409	—— ferry, slipway ...	353
Refuge harbours, British channel	5	—— fort ...	335
———, Irish channel ...	7	—— gut ...	346
———, North channel ...	8	—— light ...	335
Rennell's current ...	13	—— village, Padstow ...	46
Rheidol river...	244	Rocks nose ...	57
Rhinog Fach ...	257	Rockcliff marsh ...	410
—— Fawr... ..	255	—— village ...	411
Rhiw mountain ...	257	Rocket apparatus ...	21
Rhonddas rivers ...	180	Rockham bay, shoal ...	64
Rhos bay point ...	319	Roë island ...	382
Rhoscolyn bay, cove ...	283	———, lifeboat ...	383
———, lifeboat ...	283	Rona, carreg ...	268
——— rocks, beacon ...	283	Ronaldsway kiln ...	441
Rhosherowther church ...	103	Roos point ...	169
Rhosneigir village ...	283	Roscarraek rock ...	44
——— lifeboat ...	283	Rossall point, beacon ...	366
Rhoson, carreg ...	225	—— patches ...	367
——, maen ...	225	—— oyster grounds ...	367
Rhossili bay ...	136	Rough firth, island ...	413
———, anchorage ...	139	—— point ...	422
—— parsonage ...	144	Round island light ...	24
—— coastguard ...	136	—— islet, Longships ...	31
Rhwchiwns ...	162	Rownham ferry ...	207
Rhyddlan ...	321	Rows rocks ...	96
——— marsh ...	320	Rudder point ...	81
Rhyddland mill ...	286	Rue point ...	452
Rhyl flats ...	321	Rumney river ...	180
—— pier, light, lifeboat ...	321	Rumps point ...	47
—— town, tides ...	321	Runcorn docks ...	358
Ribble river ...	360	—— gap ...	333, 357
———, buoys ...	361, 362	Rushen castle ...	440
———, lights ...	361, 362, 365		
———, pilots, tides ...	361		

		Page
S.		
Saddle head	114	
—— point, Fishguard B. ...	233	
Sailing directions, information on	xiii.	
——, list of ...	493-500	
Saint Agnes head, beacon ...	41	
—— island	25	
—— light	23	
—— port	41	
—— Ann's head, lights ...	93	
——, lifeboat	93	
——, telegraph	93	
——, I. of Man	442	
—— Anne's pier, light ...	364	
——, lifeboat	364	
—— Asaph	320	
—— Bees' college, village	389, 392	
—— head	392	
—— light	392	
——, telegraph cable...	392	
——, tidal streams ...	391	
—— Bride's bay	218	
—— Buryan's church	31	
—— Catherine's island ...	124	
—— Colomb porth... ..	43	
—— Clear's	131	
—— David's cathedral ...	219	
—— head	228	
——, tidal streams	223, 235	
—— Dogmaels	238	
—— Donat's bluff, castle...	168	
—— Elmo's summer house ...	321	
—— Eval's church... ..	48	
—— George's channel, directions		
for approaching	5	
——, tidal		
streams	15	
—— Goven's head	114	
—— chapel, well	114	
——, new quay	115	
—— shoals	114	
—— Helen's pool	29	
—— Issel's church	126	
—— Ives bay	35	
——, anchorage	35	
—— church	35	
—— head	35	
Saint Ives, lifeboat	36	
——, pilots	36	
——, supplies, trade ...	36, 37	
—— tidal harbour	35	
——, directions	36	
——, lights	36	
——, tides	36	
—— John's church, Cardiff ...	186	
—— Margaret's island	118	
—— Mark's quay	331	
—— Martin's island, day mark ...	25	
—— Mary, port	437	
—— Mary's harbour, Scilly I. ...	25	
——, anchorage, the pool	26	
—— island	25	
——, lifeboat	25	
——, pier, depths	25	
——, road	26	
——, sound, tides ...	27, 29	
——, supplies	24	
—— town	25	
—— isle, Dee R.	418	
—— rock, Douglas	443	
——, beacon	443	
—— Michael's island	441	
—— Patrick's isle	453	
—— Petrox church	114	
—— Saviour's point	46	
—— Thomas' head, ridge...	195	
—— Tudno's church	317	
—— Tudwall's islands	263	
—— lights	264	
—— roads	265	
——, directions...	265	
——, shoals	264	
—— sound	264	
——, tides	266	
—— Twinel's church	113	
—— Vincent rock	295	
—— rocks... ..	204	
Salisbury banks, buoys ...	325, 326	
Salthouse point	137, 195	
Saltney	331	
Saltom bay	392	
Samphire islands	40	
Samson island	29	
Sanager sand... ..	213	
Sand bay	194	
—— ridge	70	
Sandhead bay	432	
Sandsfield	410	
Sandy Haven bay	102	
Sandy islet	145	

	Page		Page
Sark river, foot	411	Selker rocks, beacon	387
Sarn means a causeway.		—, light-vessel	388
— Badrig, remarks	256, 257	Sennan church	31
— Gynfelin	246-248	— coastguard	33
— Wallog	246	— cove, light, lifeboat ...	32, 33
— y-Bwch	253	Seven Stones, light-vessel ...	30
Saundersfoot bay	126	Severn river	209
— harbour	126	—, depths in	209
—, directions... ..	127	—, directions	210, 211
—, tidal light	126	—, lights	210
Sawdern point	103	—, pilots, tugs	210
Scala Fold Style shoal	387	—, tides, bore	216, 217
Scar point	162	—, canal to Gloucester ...	215
Scare rocks	429	— Thames	209
Scarf channel	387	Sharksfin rock	31
Scarlet point... ..	437	Sharpness dock	213
— stack	437	—, depths to	209
Scarweather sands	149	—, directions... ..	210
—, light vessel	150	—, lights, signals	214
Scilly islands, general remarks ...	22	—, pilots	210
—, anchorages	26	—, supplies	214
—, caution when ap-		Sharpnose point	50
—, proaching	23	Sheep rock	97
—, coastguard	25	Shell flats	367
—, dangers off	23	— wharf, buoy	368
—, description of islands ...	25, 26	Shepperdine lights	210
—, directions	27, 28	— sand	213
—, entrance channels ...	27, 28	Shipload bay	56
—, harbours in	24	Ship ledge	268
—, landmarks	22	Shoe reef	221
—, lifeboat	25	Shoot passage	211
—, lights	23, 24	Shord channel	151
—, pier	25	Shore Lanner ledge	38
—, pilots	24	Shutter point	52
—, signal station	21, 24	Signal stations for Liverpool	
—, supplies	24	285, 302, 317, 321, 323, 435	
—, tides	28, 29	—, Lloyd's	21
Scotch deep	414	—, Milford H.	93
Screel peak	390	—, Swansea	147
Screen rocks, beacon	425	—, see Telegraphs.	
Sea Fell Pikes	396	Silloth	406-408
Seabank house	168	—, anchorage off	406
Seacombe landing stage	352, 353	— bank	403
— town	356	—, bar in approach	404
Seafeld point	409	—, depths to	406
Seaforth church	334	—, directions	405
Seal rock	53	— dock	406
Seascale village, lifeboat	389	— jetty	407
—, measured mile	389	— lifeboat	407
See-me-not hill	193	—, lights, tidal	407
Seiont river	280	—, pilots, tugs	407
Seldom-seen bank	382	— road	406
Selker point	387	—, storm warnings	407

	Page		Page
Silloth, tides	407	Solway firth, ford	409
—— town, trade	407, 408	——, harbours in	391
Sinniness, mull of	430	——, lifeboats 394, 402, 407, 412	
Sir Christopher's knoll	146	——, light-vessel	404
Six and Four feet flats	339	——, pilots	393, 397, 401
Skear rock	124	——, telegraph cable to	
Skerran, the	440	I. of Man	392
Skerries, light	294	——, tidal streams	391
——, dangers near	294-296	—— limit	411
——, directions, outside	296	——, sandbanks in 402-404, 416	
——, inside	297	——, viaduct	410
Skerton	376	Sound, Lit. Ross	417
—— weir	373	—— rock	120
Skinburness	408	Soundings in approaches to Bristol	
—— or Cote light	407	and St. George's channels 2	
Skinner rock	288	——, datum of	iv.
Skinner's monument	289	South channel, Ribble R.	362
Skinvynecks	34	—— Barrule	455
Skokham island, spit	87	—— Bishop, light	224
——, race off	91	——, anchorage near	224
—— Stack	87	—— Glen hill	413
Skomar island	87	—— Haven, I. of Man	434
—— anchorages, landing	88	——, Skomar	88
——, race off	91	—— Hook fort point	95, 98
Skrinkle haven	116	—— Porthwan point	286
Skyre Burn bay	422	—— Stack, lights	284, 285
Skysea islet	145	——, signal station	285
Slades bluff	145	——, tidal streams 284, 290	
Sloyne road, tides	348	—— Stone, Scilly	30
Small Ord point	118	South-west rock, Smalls	83
Smalls, the	83	—— spit	198
——, channels east of	86	Southbrook Chapel point	192
——, dangers off	83, 84	Southernness	414
——, depths, westward of	85	——, tides	415
——, landing place	84	——, tidal streams	391
——, lights, signals	84	Southport, anchorage off	363
——, tidal streams	14, 84, 85	——, channels to	362, 363
Smith sound	27	——, directions	363
Snaefell	433	——, lifeboat	363
Snatchems	373	——, pier and light	363
Soch river	263	——, town	363
Soderick port	442	Southshore village	361
Solach, porth	267	Southwick water	414
Soldier point	287	Spaniel shoal	120
Solva creek	219	Spanish head	436
Solway firth, general remarks	390	—— ledges	27
——, anchorages 399, 402, 406		Spencers spit	339
——, bar	404	—— tides	346
——, buoys	391, 403, 404	Sprat ridge	59
——, caution	390	Spritsail Tor cliff	136
——, directions	405, 406	Spur islet	118
——, fairway buoy	404	Stack, I. of Man	435
		Stack rock fort, Milford H.	97

	Page		Page
Tenby harbour, lifeboat ...	125	Tidal streams, Wigton bay ...	421
———, supplies ...	125	Tidenham stone ...	212
——— road ...	124	Time signal, Liverpool ...	354
———, directions... ..	122	———, Swansea ...	156
Ten-feet bank ...	305	———, Whitehaven ...	394
Thick head ...	435	Tindwall hill ...	452
Thistle bluff ...	146	Tings rocks ...	50
——— rock ...	454	Tintagell head ...	45
Thorn island, rock, fort ...	97	Tintern abbey ...	212
Thornwell's farm ...	212	Toes rocks ...	113
Thousla rock, beacon ...	436	Tone river ...	96
Three-fathoms bank, Solway F. ...	403	Tongue land bridge... ..	419
——— tongue ...	339	Tordoff point ...	409
Three stone oar rocks ...	34	Torpedo practice ground ...	103
Tibbet point ...	53	Torr house, lake, point ...	418
Tickhill scar ...	408	—— point ...	412
Tidal datum ...	iv	Torridge river ...	58
——— streams, Arklow ...	17	Torrington ...	59
———, Bardsey ...	16, 269, 272	Towan bay ...	41
———, Bishops, south ...	226	——— head ...	41
———, Breaksea ...	169	———, coastguard ...	42
———, Bristol channel ...	13-15	——— tidal harbour ...	42
———, Broad sound ...	91	Towy and Taff rivers ...	127-131
———, Caldý ...	121	——— bar ...	128
———, Caermarthen bay ...	117	———, buoyage ...	129
———, Cardigan bay ...	16	———, depths ...	128
———, Foreland ...	71	———, directions ...	130
———, Holms ...	177	———, lifeboat ...	131
———, Irish channel ...	15-17	———, tides ...	130
———, Isle of Man, 17, 436,		Towyn town ...	252
439, 445, 451, 454		Traeth means sand.	
———, Jack sound ...	90	——— mount ...	238
———, Kemmaes head ...	236	——— Bach ...	258, 304
———, Lynus point... ..	302	——— Dulas ...	303
———, King road ...	202	——— Mawe ...	258
———, Luce bay ...	428, 429	Trai means exposed by the ebb.	
———, Lundy island ...	54	———, carreg ...	225
———, Mersey R. ...	341	Tranmere, landing stage ...	353
———, M. of Galloway ...	18	——— town ...	356
———, North channel ...	17	Trawler's dread ...	120
———, St. Bride's bay ...	220	Trawling ground, Cardigan B. ...	244
———, St. David's head ...	235	Trebetherick point ...	44
———, St. George's channel ...	15-17	——— coastguard ...	46
———, Saltees light vessel ...	15	Trecastell point ...	307
———, Seven stones ...	14	Trecrobben hill ...	35
———, Skerries ...	296	Treen cove, coastguard ...	34
———, Smalls ...	15, 84	Trefydd point ...	251
———, Solway ...	391	Tregenna castle hotel ...	35
———, South Stack ...	284	Treharnes point ...	170
———, Swansea ...	151	Tremadoc bay ...	258
———, Tremadoc bay ...	257	Trenoromb hill ...	35
———, Tuskar ...	15	Trentishoe village ...	69
———, Watchet ...	75	Treowen fort... ..	95

	Page
Trepont	283
Trereen farm... ..	34
Trescow island	25
Trevaunance port	41
——— coastguard	41
Trevelgue head	43
Trevor port, light	274
Trevose head	43
———, coastguard	43
———, light	43
Trewent point	116
Tri Maen rocks	230
Trimsaran valley	132
Trinity estab., Holyhead	292
———, Milford H.	109
Trinity rock, Scilly I. . .	28
Tripod bank	271
Trisky ledge	27
Trwyn Du, Menai S.	306
———, light	306
Trwyn-y-Garth	308
Trwyntal point	274
Trwyn point	266
Tucker rock	90
Tuns rocks	111
Turbob bank	96
Tuskar, tides off	15
Tusker rock	163
Tut head	147
Twillcurdotin farm	247
Two feet bank, Solway F.	403
Ty-wyn church	320

U.

Uchaf means upper.	
———, llech	226
——— rock	229
Ulverston canal	379
———, channel to	379
——— town	379
Ulverstone rock	211
United Service college	63
Uphill bay, creek	193
——— village	193
Upper Mersey. <i>See</i> Mersey	356
Urr water	413
Usk patch	189

	Page
Usk river, depths in	188
——— light	189
—— town	188

V.

Vada, port	443
Vale of Neath wharf	159
Valley of rocks	69
Varley point... ..	47
Victoria bank	296
——— pier, Douglas	444
——— sea mark	334
Villier rock	44
Vyneck rocks	33

W.

Wadebridge	46
Wains hill	195
Wallasey churches	334
——— landing stage	353
Walney island	385
——— lights	380
——— channel, directions	383
Wallog farm	246
———, Sarn... ..	246
Walton bay	195
———, anchorage	201
——— castle	196
——— church	334
Wampool river	408
Warlo bluff	128
Warren church	113
Warrington town	358
Wart bank	436
Warton	365
Watch hill	34
Watchet harbour	74
———, directions	74
———, lifeboat	75
Watchet harbour, lights	74

	Page		Page
—————, signals ...	74	Whitehaven, lifeboat ...	394
Watergate bay ...	42	————— lights, caution ...	391
Waterloo, coastguard ...	343	—————, tidal ...	393
Watermill cove ...	28	—————, pilots, tugs ...	393
Watermouth cove ...	68	—————, tides, streams ...	391, 393
————— castle ...	68	—————, time signal ...	394
Watertown ...	61	—————, town, supplies ...	394
Waver river ...	408	Whitehill	414
Wear Gifford ...	59	Whitesand bay, Lands End ...	32
———— point, tongue ...	98	—————, Ramsey S. ...	222
Weather signals ...	12	Whitestone bank ...	450
Weaver docks ...	358	Whithorn, Isle of ...	424
———— river ...	333	————— port ...	425
Welsh channel, Dee R. ...	326	—————, directions... ..	425
—————, directions ...	327	—————, lifeboat ...	425
———— hook ...	198, 199	—————, tides ...	425
———— grounds ...	198	Widemouth bay ...	48
Welshman gut ...	326	Widnes dock ...	357
Weltog islet ...	281	Wigton bay, directions ...	420
West island, S. Tudwall's ...	264	—————, tidal streams... ..	421
———— scar ...	408	————— port, depths ...	427
———— Bank dock ...	357	—————, directions ...	427
———— Freshwater bay ...	112	————— sands ...	427
———— Hoyle bank, buoys ...	324, 338	—————, tides ...	421
———— Mouse, beacon ...	295	————— town ...	427
———— Platters ...	295	Wild road ...	328
———— Tarbat bay ...	431	Wildgoose race ...	91
Western Blackstone ...	89	William port ...	429
Westmoor cliff ...	116	—————, anchorage off ...	430
Weston bay ...	193	Willow park point ...	48
—————, anchorage ...	194	Winds and weather ...	8-10
—————, telegraph cable ...	194	Wiseman's bridge ...	126
————— docks ...	358	Witford point ...	157
————— downs ...	196	Wollacombe Tracey... ..	63
————— ledge, pier ...	193	—————, lifeboat ...	64
————— point, town ...	358	Wolves ...	176
————— super mare ...	194	Wood church ...	333
—————, coastguard ...	194	Woodcock ledge ...	26
—————, lifeboat ...	194	Woodside landing stage ...	353
Westward ho ...	62	Woodspring abbey, point ...	195
Wharf point ...	196	Woolhouse rocks, beacon ...	121
White bank ...	117, 126	Woolpack rock ...	27
———— Horses ...	54	Wooltack point ...	88
———— Oyster ledge ...	149	Workington ...	396-398
Whiteford burrows ...	136	————— bank ...	402
———— point ...	136	————— directions ...	397
———— scar and sands ...	138	————— harbour and dock ...	396
—————, light ...	140	—————, lights, signals ...	397
Whitehaven ...	392-395	—————, patent slip ...	398
—————, anchorage off ...	392	—————, pilots, tugs ...	397
—————, directions ...	394	—————, town, trade ...	398
—————, docks ...	395	Worle hill, ridge ...	194
—————, harbours ...	392, 393	Worms head ...	135

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MELBOURNE	-	-	J. Donne & Son	-	-	59, Elizabeth Street.
NEWCASTLE	-	-	R. C. Knaggs & Co.	-	-	Hunter Street.
NEW YORK	-	-	Eggerts & Sons	-	-	74, Wall Street.
"	-	-	Bliss & Co.	-	-	128, Front Street.
NEW ZEALAND	-	-	W. N. Bannatyne & Co.	-	-	Wellington.
PARIS	-	-	C. & A. Jeancourt	-	-	224, Rue di Rivoli.
"	-	-	Challamel & Co.	-	-	5, Rue Jacob.
SHANGHAI	-	-	Lane, Crawford, & Co.	-	-	Merchants.
"	-	-	Morrison & Co.	-	-	Do.
SINGAPORE	-	-	Crawford	-	-	Sailors' Home.
SYDNEY	-	-	Bullard & Co.	-	-	George Street.
SUEZ	-	-	Capt. Weston	-	-	Port Office.
VALPARAISO	-	-	Shringley & Westcott	-	-	Calle Cabo.
VANCOUVER ISLAND	-	-	Hibben & Co.	-	-	Victoria.
VIENNA	-	-	Gerold & Co.	-	-	Buchandlung.

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